PSYCHE

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NEW NEARCTIC TIPULIDAE (*DIPTERA*).[1]

By Charles P. Alexander,

Ithaca, N. Y.

The following crane-flies, received from various correspondents during the past few months, are believed to be new to science.

Limnobia argenteceps sp. nov.

Antennæ 15-segmented; pleuræ yellow, with a brown band; wings spotted; Sc short, ending before the origin of Rs.

♂, Length, 4.6 mm.; wing, 5.9 mm.

Head: rostrum and palpi black; antennæ 15-segmented, with the segments all black, flagellar segments rounded-ovate; front, vertex and occiput black with a conspicuous silvery-grey bloom; genæ darker.

Thorax: pronotum light brownish-yellow; mesonotum, præscutum: in front and on the lateral margin, rather bright yellow; an indistinct broad, brown, median stripe which spreads out behind and covers the entire sclerite before the suture; scutum brown, paler, yellowish, medially; scutellum and post-notum brown. Pleuræ yellow, with a broad brown band extending from the cervical sclerites back to the halteres and base of the abdomen. Halteres, pale at base; remainder, darker, brown. Legs: coxæ bright yellow; trochanters yellow; femora yellowish-brown, darker toward the tip; tibiæ and tarsi brown.

Wings: hyaline, veins brown; a brown spot at the tip of Sc, extending around the base of the sector; a large square stigmal spot; all cross-veins and deflections of veins, narrowly marginal with brown; tip of the wing and ends of all of the veins, faintly tinged with brown. Venation (See fig. 1): Sc short, Sc_2 at the tip, ending before the base of Rs; Rs rather square at its origin; basal deflection of Cu_2 before the fork of M.

Abdomen: tergum dark brown, the extreme apice of each sclerite and a broad median patch on the base of segments 1 to 6, yellow; sternum mostly pale yellow, the lateral margins and an indistinct, sub-apical, cross-band, brown. Hypopygium yellowish: margin of the 8th tergite almost straight; pleural pieces, cylindrical, thickly beset with stout hairs, bearing apically, a large pale segment which is likewise beset with hairs, and armed at its tip with a slender, chitinized projection, curved at its ends; guard of the penis long, prominent, enlarged apically and notched.

[1] Contribution from the Entomological Laboratory, Cornell University.

Holotype, ♂, Huachuca Mts., Arizona; Aug. 1905 (H. Skinner, Coll.) Type in coll. Acad. Nat. Sci. Phil.

The reference of this insect to *Limnobia* is merely provisional; I do not care to add a new genus to our already too long list, nor do I know of any genus into which this species will accurately fit. It is remarkable in possessing antennæ which are 15-segmented. The hypopygium is more like that of *Limnobia* than it is like that of *Furcomyia*, still the appearance of the insect, and its venation, are strongly suggestive of the last-named genus. It may be well to compare it with this genus; in Doane's Key (Ent. News, Jan. '08; p. 5–7) it runs down to couplet 30, but runs out because of its spotted wings. It is related to *Furcomyia signipennis* Coq. of California (J. N. Y. Ent. Soc.; vol. 13; p. 56; (1905).

Elliptera astigmatica sp. nov.

Wings without a stigmal spot.

♂ Length, 8.75 mm.; wing, 14 mm.

Head: rostrum and palpi brownish-black; antennæ, segment one, elongate-cylindrical; flagellar segments oval, similar to one another in shape, gradually smaller; antennæ black; front, vertex and occiput black; the occiput narrowed behind. (It is probable that the head is covered with a grey bloom in fresh specimens; the type is injured.)

Thorax: very convex, præscutum large, greyish-brown, clearer grey along the margins and on the pleuræ; the præscutum is very large, so that the meso-thoracic legs are very widely separated from the prothoracic pair, but close to the metathoracic; scutum, scutellum and post-notum dark grey, the caudal margin of the scutellum brown. Halteres light yellow, the knob brown. Legs: fore coxæ dark brown, yellowish at the tip; remainder lacking; middle and hind legs, coxæ yellowish-brown; femora and tibiæ obscure yellowish-brown; tarsi lacking.

Wings: hyaline, with a faint yellow suffusion in cells C, Sc, R_1 and anterior portions of R_3; stigma entirely absent; veins, brown, R_1 darker than the others; a brownish suffusion below Cu and 2nd Anal. Venation (See fig. 2.): Costa in vicinity of Sc bellied out cephalad and incrassated; Sc rather long, lying closer to C than to R; Sc_2 far retracted, so that Sc_1 is about equal to Rs; R long, ending before the wing-tip, strongly incrassated to near the origin of R_{4+5}; Rs long, arising at an extremely acute angle, diverging only slightly from R_1; R_{2+3} in a direct line with Rs; basal deflection of R_{4+5} short, strongly arcuated, beyond cross-vein *r-m*, straight, parallel with R_{2+3} to near the tip when it runs somewhat caudad; M weak, on a line with M_3 and Cu_1; deflection of M_{1+2} almost as long as the cross-vein *r-m*; M_{1+2} proximad of *m* longer than that portion beyond it, making cell 1st M_2 very elongate; Cu strong, Cu_1 about two-thirds as long as Cu_2; Cu_1 fuses with M just before the fork; 1st A very weak; 2nd A stronger, gently bisinuate; anal angle rather prominent.

Abdomen greyish on dorsum, pleuræ darker, blackish; sternum testaceous.

Holotype, ♂, Roger's Pass, British Columbia; July 30, 1908. (J. Chester Bradley, coll.)

Type in Cornell Univ. coll.

This species agrees with the other American species, *clausa* O. S. of California, in its possessing a median cross-vein. It differs in the entire absence of a stigmal spot. I have seen the types of *clausa* in Cambridge, thanks to the kindness of Mr. Henshaw, and find that that portion of R_1, just underneath the stigma is bent caudad, and, beyond the stigma, regains its former level; no such condition exists in *astigmatica*.

Erioptera (*Mesocyphona*) **distincta** sp. nov.

Vertex variegated; mesonotum clear light grey; dorsal stripes rather broad, clear; pleural stripes very distinct, clear-cut; femora with two dark bands, excepting the middle pair which has one; wings greyish, spotted and dotted, on the veins and in the cells, with white.

♂, Length, 3.6—3.8 mm.; wing, 4.6 mm.

Head: palpi brown; antennæ light yellowish-brown; vertex with a large, clear grey, oval spot, surrounded by a brown border; the outer margins of the vertex, nearest the eyes, fawn-colored; occiput dark brown. Cervical sclerites pale yellow, dorsally with two dark spots.

Thorax: pronotum whitish, the scutellum interrupted medially with a dark pit; mesonotum, præscutum clear light grey, the lateral margins narrowly greyish; a brown stripe on either side, beginning near the caudal end of the pronotum, continuing backward; a brown stripe on either side of the grey median vitta. Pseudo sutural pits[1] elongate-oval, pale; the space anterior to this fovea is pale, fawn-colored; præscutal, or tuberculate, pits, distinct, black, separated from one another by a distance equal to one and one-half the diameter of one; these pits are located in the median ground stripe near the proximal edge of the dark dorsal stripes; scutum, greyish, the vittæ of the præscutum continued backward onto this; scutellum light yellowish-brown, darker anteriorly; post-notum grey, tri-vittate with dark brown. Pleuræ dark brown; a narrow yellowish-white pale stripe running from the lateral margin of the cervical sclerites, caudad; broadening out above the fore coxa and continuing to the wing basis; a broad, clear, silvery-white stripe, narrowest anteriorly, beginning back of the fore coxa, running back to the base of the abdomen; sternum clear grey. The pleura has the appearance of having three dark and two pale bands. Halteres, stem white, knob pale brown. Legs: fore and hind femur, yellow with a broad sub-basal, and a narrower, sub-apical, brownish-black ring; tibiæ and tarsi whitish; extreme tarsal segments darker; middle leg, similar, but femur has only the sub-apical dark band.

Wings greyish, browner on the cephalic half, with numerous white spots and dots, these largest along the costa and on the cord; the cells are speckled with numerous fine dots.

Abdomen light brownish-yellow; a broad, brown, median stripe.

Holotype, ♂, Highrolls, New Mexico; May 31, 1902. Paratypes, 3 ♂'s; Highrolls, New Mexico; May 31, June 2, and June 10, 1902.

Types in coll. Acad. Nat. Sci. Phil.

This species differs from its nearest ally, *caloptera* Say, in its very clearcut pattern of coloration, clear grey with distinct pleural stripes, not yellowish with indistinct pleural stripes, etc.

Trimicra pygmæa sp. nov.

Small; brown; basal half of antennæ yellow, remainder brown; wings greyish with a short pubescence in all the cells.

♀, length, 3.2 mm.: wing, 3.5 mm.

Head: rostrum and palpi dark brown; antennæ, basal seven segments light yellow, terminal segments dark brown; front, vertex and occiput dark brown.

Thorax: dark brown, the lateral margin of the mesonotal præscutum dull yellowish; scutum, scutellum and post-notum dark brown, dark stripes not evident; pleuræ dark brown, more yellowish near the dorsal margin. Halteres yellow. Legs: coxæ and trochanters yellowish-brown; femora, tibiæ and tarsi brown.

Wings: hyaline with a slight greyish tinge; stigma indistinctly grey; veins brown, R more yellowish. Wing covered in all the cells with a thick short pubescence. Venation: (See fig. 3) Sc_2 retracted far back from the tip of Sc_1; Rs leaves R_1 at an acute angle; fork of R_{2+3} deep, R_{2+3} being a little shorter than the basal deflection of Cu_1; cross-vein *r* just beyond the fork of R_{2+3} and far removed from the tip of R_1. Abdomen: dark brown; in the ♀ with the valves of the ovipositor rather short, yellow.

Holotype: ♂, Woodworth's Lake, Fulton Co., N. Y. (alt. 1660 ft); Aug. 22, 1910 (Alexander, coll.). Allotype; ♀, with the type. Paratypes: ♀, Wooster, Ohio; Sept. 20, 1911, on grass-lands. (Houser, coll.) In coll. John Houser. ♂ Coy Glen, Ithaca, N. Y.; May 28, 1912; (Alexander and Sheffield.)

The types are mounted in balsam, in the author's collection. Related to T. *anomala* O. S. but much smaller and quite differently colored; Mexican specimens which I have determined as T. *anomala* may, or may not, be conspecific with T. *pilipes* Fabr. of Europe (Compare Osten Sacken, Western Dipt., p. 200.) If so, it is easily separated from *pygmaea* by its non-pubescent wings.

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[1] I have applied the term '*pseudosutural pits*' to the deep impressions on the antero-lateral margins of the præscutum existing in many Tipulidæ (*humeral pits* of Osten Sacken). The '*double dots*' of Osten Sacken are spoken of above as the '*tuberculate pits*.'

Limnophila laricicola sp. nov.

Small; antennæ of the ♂ elongate; color of the body light yellow; wings subhyaline.

♂, Length, uncertain, abdomen broken; wing, 5.4 mm.

Head: antennæ elongate, the segments indistinct, twisted, elongate-ovate, narrowed at the ends, brownish in color; front, vertex and occiput light brown, but discolored, and possibly different in fresh material.

Thorax: pronotum brown; mesonotum, præscutum brown on the anterior margin; a dark brown spot on the frontal third of the sclerite in a median position; remainder of the sclerite light yellow, sub-shining, with a sparse pale bloom; scutum and post-notum light yellow, the latter with an indistinct narrow brown median stripe; pleuræ yellow, darker near the dorsal margin. Halteres, stem pale, knob darker. Legs: coxæ and trochanters light yellow; remainder of the legs brown, rather darker outwards.

Wings: subhyaline, stigma indistinct, brown. Venation (See fig. 4): Sc rather long, extending to beyond the fork of Rs; cross-vein *r* at the tip of R_1; Rs short, less than M_1 or M_2 in length; R_{2+3} rather long, as long as Rs, gently arcuated; R_2 rather oblique, cross-vein *r* near its middle; deflection of R_{4+5} about as long as cross-vein *r-m;* petiole of cell M_1 moderately long, about three-fifths of cell M_1; basal deflection of Cu_1 beyond the middle of cell 1st M_2. Cell R_2 very acute at its proximal angle; cell 1st M_2 long and narrow.

Abdomen broken.

Holotype, ♂. Canada Lake, Fulton Co., N. Y.; June 20, 1911 (Alexander). Occurred in an extensive sphagnum bog, on vegetation growing underneath larch trees. (altitude 1550 feet)

Type in author's collection.

This species by its elongate antennæ in the ♂, is allied to *poetica* O. S. I thought that it was a small ♂ of this species until I saw the types in Cambridge. *Poetica* is conspicuously larger, with quite different antennal structure. In *laricicola*, the antennal segments are twisted, and the sutures between them indistinct, producing an appearance quite different from that which obtains in the male sex of *poetica*, *tenuipes*, *niveitarsis*, etc. Venationally, this new species differs from *poetica* in its longer R_{2+3}, shorter petiole to cell M_1, etc. Unfortunately my type, and only specimen, was recently accidentally damaged.

Eriocera albihirta sp. nov.

Antennæ short in the ♂; cell M_1 present; body densely clothed with long white hairs.

♂ Length, 15 mm.; wing, 15.6 mm.; antenna, 4.5 mm.
Fore leg, fem. 8 mm.; tibia, 10 mm.
Middle leg, fem. 9.2 mm.; tibia, 8.4 mm.
Hind leg, fem. 12 mm.; tibia 12.6 mm.

Head: rostum and palpi dark brown; antennæ, first segment large, cylindrical, brown; remainder of antennæ black with black hairs. Front wide, the frontal tubercle not prominent; front, vertex and occiput, medium brown densely clothed with long pale hairs; a spot on the front just behind the base of the antennæ, paler, golden-yellow.

Thorax: mesonotal præscutum dark dull black without apparent stripes (though these may have been destroyed by some means or another), the entire sclerite densely clothed with elongated white hairs, very conspicuous; those on the dorsum darker and shorter, those on the lateral margin of the sclerite exceedingly conspicuous; scutum dull black; scutellum dark brown, also with numerous pale hairs; post-notum black. Pleuræ light grey with dense white hairs; the light color of the pleuræ renders it probable that the dorsum is grey with darker stripes, in living material. Halteres, stem light brown, knob darker brown. Legs: coxæ brown, with a grey bloom; trochanter brown; fore femora, basal half brownish-yellow; apical half dark brown, uniform throughout; tibia and tarsi dark brown; middle leg, femora with rather more than the basal half light-colored; hind leg, femora with only the extreme base yellowish.

Wings: subhyaline or light brown, more brownish near the veins; cells C and Sc brownish-yellow; stigma small, oval; veins brown. Venation: (See fig. 6); Sc extending beyond the fork of R_{2+3}; R long, cross-vein *r* about one-half as long as that portion of R_1 beyond it; *r* before the middle of R_2; cell M_1 present. Venation almost exactly like the eastern *E. brachycera* O. S.

Abdomen: tergum uniform dark brown, the lateral margin pale yellowish, and provided with long pale hairs, these longest on the basal segments; hypopygium yellowish-orange; sternum more greyish.

Holotype: The labels read '22 California. No. 846. Coll. Hy. Edwards.' Probably from Marin Co.

Related to *E. brachycera* O. S. but darker and clothed with long pale hairs much longer than in *brachycera*. The basal segments of the antennæ in *brachycera* are very light yellowish-red, not brown; the front of *brachycera* in the vicinity of the tubercle is uniformly pale; the thoracic dorsum may or may not be similarly colored in the two species (see statement, above, concerning the condition of the thorax in *albihirta*). In *brachycera* the legs are much lighter-colored with narrow blackish tips to all the femora; in *albihirta* the femoral tips are uniform brown and very broad.

Eriocera fultonensis sp. nov.

Antennæ short in both sexes; cell M_1 absent; body coloration dark brown; præscutum four-striped; wings light brown; cross-vein *r* far before the fork of R_{2+3}.

♂, Length, 9.6–10.2 mm.; wing, 9–10.4 mm.

♀, Length, 11.2–11.5 mm.; wing, 10.5–11.3 mm.

Head: palpi dark, blackish, rostrum much paler brown; antennæ short in both sexes; scapal segments dark above, reddish-yellow underneath; flagellar segments black. Front, vertex and occiput black with a grey pruinosity, most distinct behind the eyes.

Thorax: mesonotal præscutum light yellowish-brown with a dark brown stripe on either side of the paler median vitta, these stripes broadest in front, narrower behind, ending just before the suture; a shorter, curved, lateral stripe on the lateral edge of the sclerite, beginning just behind the pseudo-suture, continuing to the transverse suture; scutum, scutellum and post-notum blackish, scantily grey pruinose; pleuræ unicolorous greyish-black. Halteres, base of stem, pale, yellow; remainder of stem, and the knob, dark brown.

Legs: coxæ light brown; trochanters and basal three-fourths of the femora, light brownish-yellow; apical fourth of the femora, brown; in the fore-legs, the apical half of the femur is brown; tibia light brown, the tip black; tarsi brown.

Wings: veins dark brown; membrane rather uniformly tinged with light brown; stigma small, delimited externally by the radial cross-vein; extreme tip of the wing rather darker. Venation (See fig. 7): cross-vein *r* near the tip of R_1, situated far before the fork of R_{2+3}; R_2 much shorter than R_{2+3}; cell M_1 absent; basal deflection of Cu_1 slightly before the fork of M.

Abdomen shiny black, including the large hypopygium; in the ♀, the valves of the ovipositor are likewise black.

Holotype, ♂, Sport Is; Sacandaga R; Fulton Co.; N. Y. June 28, 1911. (Alexander, coll.) Allotype, ♀, with the type. Paratypes, 5 ♂, 5 ♀, with the type.

Types in author's collection.

Nearest related to *E. fuliginosa* O. S. (East. U. S.), from which it is readily distinguished by the lack of a grey bloom on the thorax, the shiny jet black abdomen and genitalia, etc. In normal individuals of *fultonensis*, cross-vein *r* is far before the fork of R_{2+3} (See fig. 7). In rare instances, however, the cross-vein is much nearer to the fork though never quite at it. Specimens which I refer to *fuliginosa*, provisionally, show a venation similar to that described for the species (See fig. 8); the coloration is very dark, however, and comparison with the type may prove them to be novelties. *E. fultonensis* differs from *E. gibbosa* Doane[1] (Mich.) in the same venational peculiarity.

Eriocera cinerea sp. nov.

Cell M_1 absent; color of the thorax light grey; stripes on the mesothoracic præscutum indistinct; cross-vein *r* far beyond the fork of R_{2+3}.

♀, Length, 11.4 mm.; wing, 11.2 mm.

♀, Head: rostrum yellow; palpi yellowish-brown; antennæ, segments one

[1] Doane, Journ. N. Y. Ent. Soc.; vol. 8; p. 193; pl. 8, fig. 10. (1900)

and two, light orange-yellow beneath, light brown above; flagellar segments brown. Front and clypeus light orange-yellow; vertex and occiput light grey, more brownish medially, paler on the vertex behind the eyes, and on the genæ.

Thorax: prothorax, scutum dark brown with a grey bloom and prominent pale hairs; scutellum dark brown medially, the ends conspicuously orange-yellow. Mesothorax yellowish-grey, the præscutum with four very indistinct darker lines; the middle pair long, confluent or nearly so at their cephalic ends; lateral pair short, beginning behind the prominent rounded, black pseudo-sutural fovea; scutum and scutellum brown with a clear light grey bloom; post-notum dark brown. Pleuræ light grey; halteres, stem brownish-yellow, knob brown. Legs: coxæ and trochanters rich orange-yellow; femora light brownish-yellow, the extreme tip darker, brown; tibiæ, extreme base brown, remainder yellowish-brown, insensibly darker apically; tarsi brown.

Wings sub-hyaline or very pale brown; costal and subcostal cells light yellow; stigma ill-defined, yellowish-brown; veins brown. Venation (See fig. 9) Sc short, ending before the fork of R_{2+3}; R_{2+3} slightly longer than that portion of R_2 before cross-vein *r*; cross-vein *r* inserted near the tip of R_1 and far beyond the fork of R_{2+3}; cell M_1 absent; cell 1st M_2 elongate.

Abdomen: tergum dark brown, the lateral margins of the sclerite broadly, the caudal margin narrowly, brownish-yellow; valves of the ovipositor brownish-orange; sternum greyish-brown.

Holotype. ♀, Boston, Massachusetts.

Type in author's collection.

Related to *fuliginosa* O. S. but head and thorax conspicuously grey, not brown; abdomen not uniform brown; cross-vein *r* situated far beyond the fork of R_{2+3}, etc. The female of *E. wilsoni* O. S. (East U. S.), of which I have seen the types in Cambridge, is unknown. This new species cannot be that sex of *wilsoni* because of its totally different body-color. *E. longicornis* Walker is quite a different species; its venation seems never to have been figured (The figure in Needham's 23rd Rep't of the N. Y. State Entomologist, is not *longicornis*, but *spinosa*.) so I include a drawing. (See fig. 10.)

Rhaphidolabis neomexicana sp. nov.

Cross-vein *m* of the wings absent; wings pearly-white with a distinct dark brown stigmal spot.

♀, Length, 5.4 mm. wing, 7.6 mm.

Head: rostrum and palpi dark brownish-black, antennæ black; head dark brown, sparsely grey pruinose. Thorax: mesonotal præscutum dark brown, very sparsely grey pruinose without distinct darker stripes, though rather deeper-colored medially; scutum, scutellum and post-notum dark brown with a faint grey

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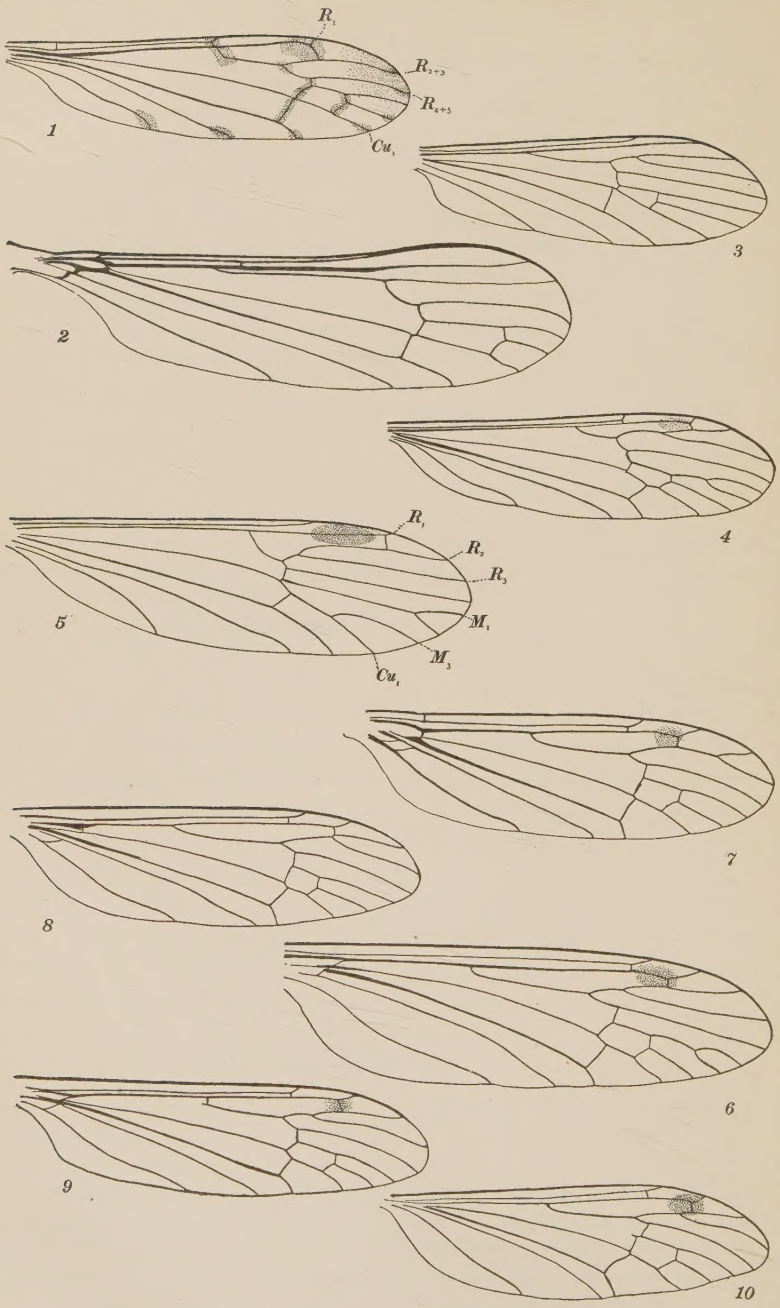

Alexander—New Nearctic Tipulidæ

dust. Pleuræ dark brownish-black, grey-dusted. Halteres, stem pale, knob brown. Legs: coxæ brownish-yellow, more greyish anteriorly; trochanters brownish-yellow; femora and tibiæ uniform medium brown; tarsi gone.

Wings: hyaline or sub-pearly; a prominent elongate dark brown stigmal spot; veins brown, the longitudinal veins rather paler at the wing-root. Venation: (See fig. 5): Sc long extending beyond the fork of R_{2+3}; R_1 long, cross-vein *r* very near its tip; Rs short, oblique; R_{2+3} very short, only a little longer than cross-veins *r* or *r-m*; cross-vein *r* beyond the middle of R_2; M_1 about as long as Rs; no cross-vein *m*; basal deflection of Cu_1 beyond the fork of M.

Abdomen: dark brown, the pleural sutures lighter brown; valves of the ovipositor light colored, brownish-yellow.

Holotype, ♀, Beulah, New Mexico: June 29, 1902.

Type coll. Acad. Nat. Sci. Phil.

Most closely allied to *R. tenuipes* O. S. of the Eastern United States, but differs in its wing coloration, apparent lack of thoracic stripes, dark stigmal spot and venational details, *i. e.*, more oblique Rs, shorter and more divergent M_1 and M_2, etc.

R. debilis Will.[1] appears to be a *Tricyphona* by its venation (R_{2+3} fused and R_4 and R_5 separate). It agrees most closely with *T. vitripennis* Doane.

The members of this tribe, *Pedicini*, require careful study at the hands of some competent student who has access to an abundance of Western material. The West appears to be the center of distribution for the members of this group, which, in other parts of the continent, are represented only by a few species, or else, as in the tropics, quite lacking. I surmise that such a study, based on sufficient material, would show congenerousness of *Plectromyia* O. S. and *Rhaphidolabis* O. S., with *Dicranota* Zett.

Explanation of the Plate 13.

1. Wing of *Limnobia argenteceps*, sp. n.
2. " " *Elliptera astigmatica*, sp. n.
3. " " *Trimicra pygmaea*, sp. n.
4. " " *Limnophila laricicola*, sp. n.
5. " " *Rhaphidolabis neomexicana*, sp. n.
6. " " *Eriocera albihirta*, sp. n.
7. " " E. *fultonensis*, sp. n.
8. " " E. *fuliginosa* O. S. (or related species)
9. " " E. *cinerea*, sp. n.
10. " " E. *longicornis* Walker.

[1] Williston, Kans. Univ. Quart.; vol. 2; p. 62; Oct. 1893.

ADDITIONS TO OUR KNOWLEDGE OF THE ANTS OF THE GENUS MYRMECOCYSTUS WESMAEL.[1]

By William Morton Wheeler.

Since my paper on the honey ants was published in 1908[2] our knowledge of the distribution of these insects has been increased and two new species have been brought to light. Mr. Percy Leonard of the Raja Yoga Academy at Point Loma, California, has discovered a new subspecies of *M. melliger* and has published an interesting account of its habits and of those of *M. mexicanus mojave*.[3] During the winter of 1910 I made a second journey to Arizona and California and was able to observe the latter and several of the other subspecies in the field. The discovery of the typical *M. mexicanus* in Arizona and Southern California by Mr. W. M. Mann, Mr. Leonard and myself brings all of the known species, subspecies and varieties of the genus within the confines of the United States. The separation of these from the Old World forms, till recently regarded as *Myrmecocysti*, but now placed in Förster's genus *Cataglyphis* by Emery and Forel, is also an important step in advance, as is also the recognition by the former authority of the fact indicated in my former paper that *Myrmecocystus* is closely allied to the circumpolar genus *Lasius*, whereas *Cataglyphis* is more intimately related to another circumpolar genus, *Formica*. These diverse relationships of the New and Old World genera are most clearly seen in their respective males. An unsolved problem is still presented by some of the small species of *Myrmecocystus* and *Formica* of the subgenus *Proformica*, such as *M. lugubris* Wheeler of Arizona and *P. emmæ* Forel of Algiers, which resemble each other in the most extraordinary manner. This resemblance, however, may be due to convergence of habit, as both are desert ants. Mr. Leonard has found that *M. melliger lomaënsis* has replete, or "honey pot" workers, like the typical

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 60.

[2] Honey Ants, with a Revision of the American Myrmecocysti. Bull. Amer. Mus. Nat. Hist. XXIV, 1908, pp. 345–397, 28 figs.

[3] The Honey Ants of Point Loma, California. Trans. San Diego Soc. Nat. Hist. I, No. 3, 1911, pp. 85–113, 6 figs.

melliger, but such a physiological caste is still unknown in the subspecies *orbiceps*, *mendax*, *mimicus* and *semirufus* and in *M. lugubris* and *yuma*. All of these seem to be eminently predatory and insectivorous. The repletes of the typical *M. mexicanus* and its subspecies *mojave* have been studied by Leonard, and it is highly probable that the subspecies *navajo* presents very similar conditions.

I append a table for the identification of the workers of all the known species, subspecies and varieties of *Myrmecocystus* with some geographical and ethological notes and with descriptions of the new forms.

Table of Myrmecocystus.

1. Mandibles 9-toothed; eyes larger; head and thorax and usually also the gaster yellow 2
   Mandibles 7-toothed; eyes usually smaller; color always darker, head and thorax red or more or less infuscated 5
2. Large forms, averaging more than 5 mm 3
   Small forms, averaging less than 5 mm 4
3. Head and thorax sordid yellow, gaster brown or blackish . . *mexicanus* Wesmael.
   Head, thorax and gaster pure yellow . . . . *mexicanus* var. *horti-deorum* MacCook.
4. Head narrow; pronotum longer than broad; base of epinotum very convex; erect hairs only on anterior surfaces of antennal scapes . . *mexicanus navajo* Wheeler.
   Head broader; pronotum as broad as long; base of epinotum less convex; whole of antennal scapes with erect hairs ..... *mexicanus mojave* Wheeler.
5. Large forms, averaging more than 4 mm.; stature very variable 6
   Small forms, averaging less than 4 mm.; stature more constant 13
6. Gaster opaque or subopaque, densely pubescent; length 7–9 mm 7
   Gaster shining, with shorter and more dilute pubescence; length 4–6 mm . . 10
7. Hairs and pubescence grayish, the latter short, not silvery; length 8–9 mm. ..... *melliger* Forel.
   Hairs and pubescence silvery, the latter longer; length 7–8 mm 8
8. Head of largest workers large, orbicular ..... *melliger orbiceps* Wheeler.
   Head of largest workers smaller, rectangular 9
9. Erect hairs shorter and less abundant, obtuse or subobtuse ..... *melliger mendax* Wheeler.
   Erect hairs longer, more abundant, pointed ..... *melliger mendax* var. *comatus* Wheeler.
10. Erect hairs nearly or quite lacking on antennal scapes ..... *melliger mimicus* var. *depilis* Forel.
    Erect hairs abundant on antennal scapes 11

11. Head, thorax, petiole, antennæ and legs uniformly deep brownish red.....*melliger mimicus* Wheeler.
Thorax and posterior portion of head usually very dark red or black.....12

12. Petiole very blunt and rounded above, scarcely compressed anteroposteriorly; color of head and thorax variable..*melliger mimicus* var. *jesuita* Wheeler.
Petiole somewhat more compressed anteroposteriorly; pilosity more abundant; thorax, gaster and posterior portion of head black .....*melliger lomaënsis* subsp. nov.

13. At least the whole head and thorax light yellowish red.....14
Head and thorax largely black or dark brown.....15

14. Gaster brown, blackish or piceous.....*melliger semirufus* Emery.
Gaster red, like the head and thorax...*melliger semirufus* var. *testaceus* Emery.

15. Head, thorax and gaster black; head much longer than broad; gula flat or slightly concave .....*lugubris* Wheeler.
Most of the body dark brown; head but little longer than broad, gula convex.....16

16. Pubescence very short; thorax, gaster and much of the head dark brown; mandibles and anterior border of clypeus and cheeks yellow..*yuma* sp. nov.
Pubescence longer and more silvery; yellow of head extending further posteriorly.....*yuma* var. *flaviceps* var. nov.

Myrmecocystus melliger Forel.

Very few United States localities for this ant are cited in my former paper. I have since obtained specimens from the following places:

Texas: Laredo (C. E. Hood); Hondo and Catulla (J. D. Mitchell); Kenedy (G. P. Goll).

Arizona: Huachuca Mts. (C. R. Biederman).

New Mexico: Rito de los Frijoles (T. D. A. Cockerell); Santa Fe (F. C. Pratt).

The specimens from Kenedy, Texas, comprise two ordinary workers, a replete, a male and a winged female. I describe the female and male, because they have not been seen heretofore.

Female. Length 12 mm.

Body stout and broad. Head subrectangular, excluding the mandibles a little broader than long, a little narrower in front than behind, with feebly convex lateral and posterior borders. Eyes but little larger than in the worker major. Thorax considerably broader than the head. Petiole low, more compressed anteroposteriorly than in the worker, its upper border blunt and feebly impressed in the middle. Gaster larger, elliptical, somewhat flattened dorsoventrally.

Sculpture and pilosity as in the worker major, except that the upper surface of the head is less shining.

Head and lower portions of mesopleuræ and pronotum yellowish red; mandibles, antennæ and legs darker red; remainder of body dark brown. Mandibular teeth black. Wings tinged with yellowish; veins dark brown, stigma paler.

Male. Length 6.5 mm.

Head, excluding the eyes, longer than broad, with very convex eyes and long, slightly concave cheeks. Mandibles with an apical and a rather large, blunt basal tooth. Antennæ slender. Thorax robust. Petiole much compressed anteroposteriorly. Gaster narrow. Wings with well-developed discoidal cell.

Body somewhat more shining than in the worker. Erect hairs whitish, as abundant on the body, scapes and legs as in the worker; pubescence shorter and sparser.

Black; mandibles, anterior border of clypeus and genitalia reddish yellow; thoracic sutures, antennæ and legs brown. Wings whitish hyaline, with pale brown veins and stigma.

M. melliger orbiceps Wheeler.

Texas: Victoria (J. D. Mitchell).
Arizona: Miller and Garden Canyons, Huachuca Mts. (Wheeler)

M. melliger lomaënsis subsp. nov.

Worker. Length 4.5–5.5 mm.

Differing in the shape of the petiole and in color from the worker of the typical form. The petiole is more wedge-shaped and compressed at the superior border. Black; mandibles, cheeks, clypeus, antennæ and legs deep red. Body, and especially the head shining; pilosity and pubescence white, shorter and more dilute than in the typical form and resembling the conditions in *mimicus*.

Replete. Length 9–10 mm.

Color, especially of the head and thorax, paler and more reddish throughout; in other respects, except for the distention of the gaster, like the ordinary worker.

Female. Length 8.5–9 mm. Wings 12 mm.

Head with straight and less convex sides than in the female *melliger*, as long as broad. Eyes more convex. Petiole cuneate in profile, with flat anterior and posterior surfaces and rather sharp superior border, which is distinctly emarginate in the middle.

Sculpture, pilosity and pubescence as in the worker.

Black; gula, corners of clypeus and mandibles, except the teeth, antennal scapes and legs dark reddish brown; median funicular joints sometimes paler and more yellowish. Wings whitish hyaline; veins and stigma pale yellow; first longitudinal vein blackish.

Described from six workers, three repletes and two females taken by Mr. Percy Leonard on Point Loma, near San Diego, California.

This subspecies is closely related to the subspecies *mimicus*, but the petiole of the worker is more compressed anteroposteriorly and less blunt at the margin, and the color, especially of the head, is much darker in both worker and female. The wings of the female are fully 1 mm. longer, the erect hairs are sparser and more delicate, and the pubescence of both worker and female is more dilute.

Leonard says that this ant "is strictly diurnal in its habits and has been seen feeding upon the white flowers of *Mesembryanthemum æquilaterale*."

M. melliger mimicus Wheeler.

I have taken specimens of this widely distributed desert ant at Benson, Arizona, and have received a series of workers, males and females from Kennedy, New Mexico (W. D. Hunter) and several workers from Riverside and Whittier, California (K. J. Quayle).

M. melliger semirufus Emery.

This small, light-colored form is common in sandy spots in the desert about Yuma, Arizona. It has also been taken by Mr. P. Leonard at Point Loma, Cala. The specimens from the latter locality have the head and thorax somewhat darker than the Arizona specimens and the gaster reddish at the base, so that they are transitional to the var. *testaceus* Emery.

M. lugubris Wheeler.

This species bears a striking resemblance to certain Formicas of the subgenus *Proformica*, notably to *P. emmæ* recently discovered by Forel in the deserts of Algiers. The structure of the maxillary palpi and the shallower mesoëpinotal constriction alone indicate that the Arizona species is a *Myrmecocystus*. To my description (Journ. N. Y. Ent. Soc. XVII, 1909, p. 98) I would add that the gula is flattened or slightly concave when seen in profile.

M. yuma sp. nov.

Worker. Length 2.5–3.5 mm.

Allied to *lugubris;* monomorphic. Head only slightly longer than broad, convex above and below, distinctly broader behind than in front, with broadly rounded

lateral and posterior borders. Eyes very convex, fully half as long as the cheeks. Ocelli minute. Mandibles 7-toothed, with the apical tooth longest and curved. Clypeus convex but not carinate in the middle, flattened and depressed on the sides. Frontal area distinct. Antennæ moderately slender, scapes extending about 2/5 their length beyond the posterior border of the head. Thorax much as in the other species of the genus; pronotum as broad as long; mesoëpinotal constriction shallow; epinotum with subequal base and declivity, bluntly angular. Petiole half as broad as the epinotum, cuneate in profile, inclined forward, compressed anteroposteriorly, with flattened posterior and feebly convex anterior surface and blunt border, which, seen from behind, is straight and entire. Gaster and legs of the usual conformation.

Mandibles subopaque, densely and finely striated. Clypeus and head very smooth and shining. Thorax and gaster more opaque, especially on the dorsal surface, finely shagreened.

Hairs and pubescence white, the former short, erect, absent or very sparse on the scapes, moderately abundant on the head, somewhat sparser on the thorax and gaster, short, sparse and reclinate on the tibiæ. Pubescence short and delicate, moderately abundant on the head, thorax, gaster and appendages.

Dark brown; anterior half of head, antennæ, palpi and legs paler; mandibles, anterior border of clypeus and cheeks, tibiæ and tarsi yellowish or pale brown. Mandibular teeth black.

Described from numerous workers taken from several colonies at Yuma, Arizona.

This species differs from *lugubris* in the shape of the head and petiole, from the various forms of *melliger* in its much smaller size and in the inclination and shape of its petiole.

M. yuma inhabits small crater nests, 3–4 inches in diameter, in the pebbly desert. The nest entrance is small, often less than ¼ in. in diameter and often surrounded by small twigs and dead leaves. The numerous remains of small insects, frequently seen around the edges of the craters, show that this ant is predatory in its habits. The colonies are quite populous so that they cannot be regarded as incipient colonies of any of the subspecies or varieties of *M. melliger*. At first sight *M. yuma* may be readily mistaken for the small desert form of *Dorymyrmex pyramicus* Roger var. *niger* Pergande.

M. yuma var. **flaviceps** var. nov.

Worker. Length 2.5–3.5 mm.

Differing from the typical form in color and pubescence and in having the head more rectangular and broader in front. The brown coloration of the body and appendages is paler and the yellow color on the head extends back over the gula

and cheeks and often also over the clypeus and front. Palpi yellow. The white pubescence, especially on the thorax, gaster and posterior portion of the head is much longer and more silvery. The anterior surfaces of the antennal scapes have a row of erect hairs.

Described from numerous workers taken from several colonies at Yuma, Arizona, in the same localities as the preceding.

The craters of this variety are larger than those of the typical *yuma*, measuring 6–8 in. in diameter, with entrances nearly ½ in. across. These nests are also more populous. The precise relations of this variety to *yuma* and to the smaller forms of *melliger* (*semirufus* and *testaceus*) cannot be determined till the sexual phases have been discovered. Perhaps *flaviceps* will then have to rank as an independent species.

M. mexicanus Wesmael.

Until recently the typical form of this species was not known to occur within the United States. During August 1910 it was discovered in the desert about Hereford in Southern Arizona by Mr. W. M. Mann. Early in November of the same year I found it in the same locality, and Mr. P. Leonard simultaneously found it on Point Loma, near San Diego, California. So far as known, therefore, it is confined to Mexico and the extreme southern boundary of the United States. It is a less handsome form than the variety *horti-deorum*, as the yellow of the head and thorax and the brown of the gaster have a dirty grayish tint. Besides these differences in coloration I can detect no others of importance between the two forms.

The nests of *mexicanus* at Hereford are not abundant. They resemble those of the variety *horti-deorum* but are in adobe soil, so hard that I was unable to excavate it to a depth sufficient to expose the honey chambers. Mr. Leonard was more successful at Point Loma. He gives an interesting account of the nests and of the habits of this ant and its repletes (*loc. cit.*).

M. mexicanus var. **horti-deorum** McCook.

The range of this variety, which was formerly known to occur only in Colorado and New Mexico, has been considerably extended of late. The locality "California" given in my paper (*loc. cit.*

p. 359) on MacCook's authority, probably refers to the subspecies *mojave* (*vide infra*). During November 1910 I found a single colony of *horti-deorum* in Miller Canyon, Huachuca Mts., Arizona, at an altitude of about 5,600 ft., and Mr. A. O. Garrett has taken it at Garfield, Utah, near the southern end of Great Salt Lake. This is the most northern point at which any of our *Myrmecocysti* have been taken.

M. mexicanus navajo Wheeler.

The types of this subspecies which is easily distinguished by its small size, the much greater convexity of the base of the epinotum and the erect hairs only on the anterior surfaces of the antennal scapes, are from Albuquerque, New Mexico. I have recently received a number of workers, which agree in all respects with the types, from Kennedy in the same state (W. D. Hunter).

M. mexicanus mojave Wheeler.

The discovery of the males and females by Mr. P. Leonard at Point Loma, Cala., shows that this subspecies is very clearly marked. It was found some years ago at Pasadena, Cala., by Mrs. Elizabeth Grinnell, who kindly permits me to publish a photograph which she took of a number of living repletes (Fig. 1). Winged females have been taken by Mr. C. F. Baker at Claremont, Cala., and during December, 1910, I found numerous colonies containing workers and males, on the grounds of Pomona College in the same locality. As my original account of the worker is very brief I give a somewhat more explicit description in connection with that of the other unpublished phases.

Worker. Length 4.5–5 mm.

Head only slightly longer than broad, subrectangular, but little narrower in front than behind, with rather straight sides. Mandibles short and rather convex. Eyes large and convex, more than half as long as the cheeks. Mesonotum and neck of pronotum distinctly shorter than in the other forms of *mexicanus*, the pronotum being as broad as long. Base of epinotum more convex than in *mexicanus* and *horti-deorum* but less convex than in *navajo*. Border of petiole somewhat less blunt than in the other forms, its border sometimes impressed or feebly excised in the middle.

Body a little more opaque and pubescence and pilosity somewhat more abundant than in *horti-deorum;* coloration, especially of the gaster, more sordid or brownish yellow. In some specimens the gaster is uniformly brown. Head reddish behind; antennæ, palpi and legs pale or whitish yellow.

Replete. Length 7–10 mm.

Like the ordinary worker, except in the great distention of the gaster and the more brownish tint of the posterior portion of the head, thoracic dorsum and gastric sclerites.

Fig. 1. Repletes of *Myrmecocystus mexicanus mojave* Wheeler. (From a photograph by Mrs. Elizabeth Grinnell).

Female. Length 8–10 mm. Wings 12 mm.

Differing from the female of *horti-deorum* in the following characters: cheeks somewhat more, eyes somewhat less convex. Petiole much more compressed anteroposteriorly, with a sharper and much more deeply excised border. Body dark brown; thorax and posterior portion of head nearly black; anterior half of head, venter and thoracic sutures paler and more reddish; mandibles, except the teeth, antennæ and legs yellow or pale brown. Stigma and veins of wings dark brown. Erect hairs on the body and appendages somewhat more abundant than in *horti-deorum.*

Male. Length 4–5 mm.

Differing from the male of *horti-deorum* in having the head broader, the mandibles shorter, with broader blades, and the head, thorax and gaster dark brown or blackish, with the mandibles, antennal scapes, legs and genitalia somewhat paler, the funiculi and tarsi yellowish. The erect hairs on the body are distinctly longer, coarser and more abundant.

At Claremont, Cala., where I hurriedly examined some 20 nests of this ant, I found the craters to vary from 4–8 inches in diameter, with a central opening $\frac{1}{4}$–$\frac{3}{4}$ of an inch across. They were in dry, hard soil, often along roads or paths in situations where there was considerable vegetation, either chaparral, live-oaks (*Quercus agrifolia*) or scrub-oaks (*Q. dumosa*). In such localities the ants probably obtain their supply of nectar from the galls or from coccids and aphids on the oaks or other components of the chaparral. Mr. Leonard has given a more extensive account of the habits of *mojave* at Point Loma. He found that it is nocturnal like *horti-deorum* and that it visits aphids on carnations and roses, and the nectaries of the pepper tree (*Schinus molle*), rattle-snake weed (*Euphorbia setiloba*), honey plant (*Echium simplex*) and *Ceanothus cuneatus*. The last is a well-known element of the Californian chaparral.

THE NORTH AMERICAN SPECIES OF THE GENUS HÆMATOPOTA.

By Charles W. Johnson.

In the Eastern United States the species of this genus are comparatively scarce, and in all my collecting I have taken only two specimens. Under such circumstances it is often very difficult positively to determine an inadequately described species of the older authors: thus the only species collected in this region was naturally referred to *H. punctulata* Macq., described from Carolina. In preparing recently a faunal paper on the diptera of Florida, my attention was called to four specimens collected by Mrs. Annie T. Slosson, which were very different from Pennsylvania and New Jersey specimens which I had referred to Macquart's species. A careful study shows that the Florida specimens are undoubtedly the true *H. punctulata*, while the more Northern specimens represent a new species. The species may be tabulated as follows:

1. Antennæ entirely black ..... 2.
   Antennæ with the third joint (except the annuli) red. Front with two subquadrate black spots. Apical band of the wing broad and distinct from the anterior to the posterior margin ..... *rara* sp. nov.

2. Front tibiæ strongly dilated; wings brownish black, very finely flecked with white, apical band broad, slightly curved and reaching the posterior margin of the wing..... *punctulata* Macq.
Front tibiæ scarcely dilated; wings grayish with small, irregular flecks of white, apical band narrow, angulate and not reaching the posterior margin of the wing..... *americana* O. S.

Hæmatopota rara sp. nov.

Female. Face whitish pollinose, thickly punctated with black, the upper punctures fusing into an irregular spot near the base of the antennæ; lower half of the front shining black, slightly rugose and raised along the upper margin; the upper portion of the front grayish pollinose, with two subquadrate, velvety black spots on each side narrowly separated from the shining portion; a minute central spot also present on the upper part of the front; antennæ black, the first joint considerably thickened, shiny, slightly pruinose on the inner side near the base, third joint reddish, base yellow, annuli black; palpi light yellow. Thorax grayish black, with three pollinose stripes; humeri, a spot above the base of the wing, and the post-alar callosities, brown; pleuræ and scutellum grayish pollinose. Abdomen grayish black, with whitish pollinose posterior margins and spots on the segments similar to those of *H. americana*. Femora and coxæ black, grayish pollinose; anterior tibiæ black, basal fourth white; middle and posterior tibiæ with three black and two white bands unequal in width, the middle black band being about double the width of the others; tarsi black, base of the middle and posterior tarsi white. Stalks of the halteres white, knobs brown. Wings grayish black, with numerous white dots, some of which form ocellar spots, with the cross veins forming the center of the spots; the white apical band broad and extending from the end of the second to the posterior branch of the third longitudinal vein; stigma brown. Length, 7 mm.

One specimen collected by the author at Folsom, Delaware County, Pa., June 12, 1894.

Hæmatopota punctulata Macquart.

H. punctulata Macq., Dipt. Exot., I, 1, p. 163, 1838.

As the description of this species is brief and not accessible to many I will redescribe the species more fully:

Female. Face whitish pollinose punctated with black, the upper punctures fusing and forming an irregular transverse stripe extending from the base of the antennæ; lower part of the front shining black, upper portion of the front and vertex black, grayish pollinose, the former with two subtriangular, velvety black spots, very narrowly connected with the shining black area at the lower angle; a minute black spot above at the lower end of an obsolete vertical vitta. Thorax dull black with three very narrow grayish stripes; humeri and sternum grayish pollinose. Abdomen dull black, with grayish posterior margin and two obsolete spots near the

sides of each segment. Legs black, the tibiæ strongly dilated in comparison with other species, anterior tibiæ with one, and the middle and posterior tibiæ with two narrow bands of white; basal half of the middle posterior tarsi white. Halteres with stalk white and knobs black. Wings a uniform brownish black, finely flecked with white, those toward the base forming narrow crescent shaped markings; apical band prominent and extending from the end of the second to the end of the posterior branch of the third longitudinal vein; the outer end of all the posterior cells margined with white. Length, 6 mm.

Jacksonville, Fla., (Mrs. Slosson); Crescent City, June, (Hubbard), U. S. Nat. Museum. This species was referred doubtfully to *Hæmatopota americana* in my first list of Florida Dijeteva, (1895).

I am indebted to the kindness of Mrs. Slosson and Mr. Frederick Knab for the loan of specimens.

BOOK NOTICE.

Beiträge zur Kenntnis der südamerikanischen Dipterenfauna. Fam. Asilidae. By **Professor Dr. F. Hermann.** (Abh. der Kaiserl. Leop.—Carol. Deutschen Akad. der Naturforscher XCVI, Nr. 1, pp. 1–275, Tab. 1–5, and with 87 fig. in text, 1912, Halle).

The present work on the Asilidæ of South America covers only the subfamily Laphriinæ, and is largely based on the collection made in Chili, Peru and Bolivia in 1902–1904 by the late W. Schnuse.

The author has worked up this material in a very thorough and comprehensive manner, and his work forms a valuable contribution to our knowledge of the Diptera of that region. The work has also considerable bearing on the North American species. The author considers many of the recognized species of *Atomosia* to be only varieties of *A. rufipes* Macq., placing in this category *A. sayii* Johns., *mucida* O. S., *soror* Bigot, *punctifera* Herm., and *eupoda* Bigot. The author also calls attention to the fact that the true types of the genus *Dasyllis*, (*D. hæmorrhoa* and *croceiventris* Wied.) are very different from the North American species commonly referred to this genus, such as *D. grossa*, etc. Twenty-one new genera and sixty-one new species are described.

C. W. J.

AN ORPHAN COLONY OF *POLISTES PALLIPES* LEPEL.

By C. H. Turner,

Sumner High School, St. Louis, Mo.

It was the seventh of August, 1912. Beneath the eaves of a small, well painted railroad shed in the suburbs of St. Louis, a small nest of *Polistes pallipes* Lepel. was hanging. There were nine capped cells containing pupæ and fifteen open cells containing larvæ in all stages of development, from recently laid eggs to forms almost ready to enter the pupal stage; but the only adult inhabitant was the female wasp (the "widow-mother" or "queen") that founded the colony. This paper nest was transported several miles to my in-door insectary and suspended from a shelf. The "widow-mother" was left behind.

On the morning of the fifteenth of August four wasps were resting on the nest; evidently they had emerged over night. As I approached, they elevated the front portions of their bodies and waved their antennæ. I offered them some honey on the end of a short glass rod. They ate it immediately, even reaching out to secure it. I then offered them some honey on a steel spatula and they ate that. Placing some honey on the tip of my index finger, I presented it to them. After a moment's hesitation they cautiously sipped the honey. Normally the "widow-mother" of the colony would have fed these newly emerged wasps with food held between her jaws. Apparently these wasps possess an instinctive tendency to sip food from any small object that happens to be near.

The next morning, August sixteenth, when I approached the nest with a spatula of honey, the wasps hung down by their hind legs to sip it. One, in her eagerness, stretched so far out that she lost her balance and fell to the shelf below. Most of these wasps seemed to be eating for the gratification of self; one, however, acted differently. After sipping the honey she walked about the nest, entering cell after cell. She was feeding the larvæ on honey. The heads of the larger larvæ reached so near to the rims of the cells that I could see the nurse as she placed the drop of liquid to their mouths.

All of the four wasps that were on the nest emerged after I had left the insectary in the afternoons. On the morning of the sixteenth I arrived at the insectary at a quarter past seven. One immature wasp had partly emerged from its cell and seemed to be resting. Its head, its first pair of legs and its prothorax were protruding from the cell. After I had fed the wasps in the manner mentioned in the above paragraph, the remainder of the time was devoted to watching the emerging wasp. By slowly wriggling, it succeeded in freeing the second pair of legs, the mesothorax, the wing pads, and a portion of the metathorax. These wing pads were slender and sub-conical and did not reach quite to the beginning of the abdomen. By the time this much had been accomplished it was twenty-seven minutes after seven. From this time on, the behavior of the emerging insect consisted of various combinations of the following movements: squirming from side to side through angles varying from forty-five to ninety degrees, flexing the body forward and straightening it upwards, and bending the body to the right or to the left. Usually the antennæ were waving. Most of the time the forelegs were folded across the prosternum, occasionally they were flexed or straightened; but they took no part in either shoving or pulling. The second pair of legs were frequently pulling or pushing in an effort to help free the body. From twenty-five minutes after seven in the morning to half past three in the afternoon—nine tedious hours —this emerging wasp was watched continuously. At the last mentioned hour fatigue and other duties made it necessary for me to leave for the day. At seven o'clock the next morning this wasp was dead; but another wasp had emerged from a neighboring cell. While the wasp that died in an effort to emerge was making strenuous efforts to escape from its cell, the wasps of the nest frequently approached it; but none attempted to assist it.

On the eighteenth it was one o'clock in the afternoon when I visited the insectary. In the meanwhile two more wasps had emerged from their cells and two of the largest larvæ had woven their cocoons, thus capping their cells. These larvæ fasted from the seventh of August to the fifteenth, and from that time to the eighteenth the only food they received was honey; yet the caps they wove for their cells were as perfect as those on the other cells. Being acquainted with Margaret Morley's experience with orphan

wasp larvæ I was entirely unprepared for this outcome. Miss Morley [1] fed her larvæ on maple syrup and raw egg. The larval period was prolonged for at least two weeks and the caps spun by the larvæ were thin and transparent. The caps spun by the larvæ observed by me were as opaque as the ordinary caps.

At five minutes to two, on that same afternoon, a wasp was detected sipping honey from a Minot watch-glass. After making a flight of orientation she flew towards the nest, which was only ten feet away. Bethe believes that bees are led home by an unknown force which acts reflexly. Had he been present that afternoon he would have obtained material for much thought. That nest was on the under side of the uppermost shelf of a bank of five. The space between each shelf and the next was one foot. For descriptive purposes let us call the spaces above the shelves A, B, C, D, and E respectively. The nest was in space D. The wasp flew into space B; then, after searching around, flew out and entered space C, where it searched about for a minute or two. From there it went to space D. Although the nest was in that space the wasp failed to find it and left it and flew into space E. After searching there a short time it returned to D and succeeded in finding the nest. After feeding the young and making a flight of orientation the wasp revisited the bottle of honey. From the honey it flew, in practically a straight line, to the nest. Although this behaviour does not harmonize with Bethe's hypothesis, yet it is in perfect accord with the theory that memory of the environment assists hymenopterous insects to find the way home.

Up to the nineteenth of August not one of the wasps had been outside of the insectary. At all times they were well supplied with honey; but no substitute was made for the usual insect diet. At half past two on that day I noticed a wasp biting at the cap of one of the pupal cells. Soon a second and then a third wasp began to bite at the cap. Bit by bit the cap was picked away. As the hole became larger and larger all of the wasps on the nest began to move about in an excited manner. In an hour the hole was about as large as the cross section of the cell. The activity of the wasps was now increased. They seemed to vie with each other for a chance to bite at the neck of the partly exposed pupa.

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[1] Morley, Margaret. Wasps and Their Ways. 1900, pp. 177–180.

Soon they had severed its head from the body and had begun to feed upon the contents of its thorax. They had become cannibals! Apparently the lack of food rich in protein was the cause.[1]

Fearing that all of the pupæ might share the fate of this one, I decided to supply food containing proteids in greater abundance. In my garden I captured some small caterpillars of the cabbage butterfly (*Pieris rapæ*). I picked up one that was about one inch long and offered it to the wasps. One of the wasps seized it with her first pair of legs. Without stinging or making any attempt to do so, she proceeded at once to chew the posterior end of the larva. According to Margaret Morley,[2] Belt remarks: "A specimen of *Polistes carnifex* was hunting for caterpillars in my garden. I found one about an inch long and held it out towards it on the point of a stick. It seized it immediately, and commenced biting it from head to tail, soon reducing the soft body to a mass of pulp. It rolled up about half of it into a ball and prepared to carry it off." The behavior of *Polistes pallipses* Lepel. was unlike this. The wasp did not bite the larvæ from tail to head; but, holding the caterpillar with her fore feet, she rotated it on its longitudinal axis and gradually elevated it while she malaxated the posterior end of the squirming insect until her jaws contained a large ball of pulpy matter. She then dropped the rest of the caterpillar and flew to her nest where she fed the larvæ in the uncapped cells. She would place the juicy mass aganst the mouth of a larva and then remove it, always leaving a portion of it clinging to the mouth of the young wasp. Although several of the wasps accepted the caterpillars offered, only one seemed to take any part in feeding the young. A few of the wasps refused to accept the caterpillars that I presented to them; but they accepted such food from the jaws of other wasps. One even stole food out of the mouth of one of the larvæ. From now on these wasps were daily supplied with insect food, and they always treated the caterpillars in the manner described above. An

[1] Margaret Morley, in her book on "Wasps and Their Ways," describes a case of cannibalism. Speaking of a nest of wasps that she had captured she says: "It was necessary to keep the nest shut up in a box for several days, and in that time the confined wasps, perhaps becoming crazed with adversity, so far forgot themselves as to pull the larvæ out of the cells and suck their juices." There were numerous larvæ in the nest I studied; but the wasps passed them by and laboriously uncapped a cell and fed upon a pupa.

[2] *Op. cit.*, pp. 184, 185.

opening was left above the door, with the hope that the wasps would learn to go afield and capture their own prey.

At half past five in the afternoon, when I left the insectary for the day, all of the wasps were resting quietly or else cleaning their antennæ. At a quarter to six next morning, when I returned to the insectary, I discovered that the wasps had eaten out all of the contents of the thorax of the pupa and had thrown the body to the shelf below. The contents of the abdomen had not been touched.

From this date to the twenty-eighth of August the wasps were daily fed on caterpillars of the cabbage butterfly or on other lepidopterous larvæ. Certain wasps would accept the larvæ and, after malaxating them in the manner described above, feed the wasp larvæ and even the adults. Other wasps would not take the caterpillars. It may be that these latter wasps acted as guardians of the nest. If so they were not very efficient. The rearing on the hind legs, the darting forward and backward, the waving of the antennæ and the moving of the wings, although they may be defensive movements, certainly are not formidable. I placed some caterpillar larvæ on the top of the nest. The wasp that had been functioning as nurse captured one of them; but the other wasps on the nest made no attempt to either bite or sting them. Indeed, the only stinging done during the time these wasps were under observation was when I was attempting to induce them to feed upon the larvæ of the squash bug (*Anasa tristis*). Grasping a bug in a pair of small forceps, I offered it to a wasp. She darted at the bug and, with her mandibles, dashed it to the shelf below. I presented it to her four times in succession. Each time she behaved as above. The fifth time the squash bug was presented, the wasp darted at the forceps and struck out with her sting, which slipped along the forceps and stuck in my finger. The wasp fell to the shelf below and then returned to the nest. A few minutes later I offered her a cabbage butterfly caterpillar, to which she responded in the usual manner. Although regularly supplied with caterpillars, yet these wasps would occasionally feed their young upon honey collected from a watch glass.

At five minutes to five on the afternoon of August the twenty-eighth a wasp found the crack above the door and passed through

to the outside. A few moments later I found her hovering before the insectary, with her face towards the building, repeatedly ascending and descending and moving now to the right and now to the left in irregular curves; she seemed to be inspecting the front wall of the shed. Shortly the wasp flew into my neighbor's yard and I reëntered the insectary to await developments. Twenty minutes later she returned with a ball of malaxated food in her jaws and proceeded to feed the wasps on the nest and to enter, one by one, the uncapped cells. Once these cells contained living wasp larvæ; but now they were either empty or occupied by the dried remains of the dead. A few days ago the last large larva had woven its cocoon and the last of the small ones had died. For several days this wasp continued to hunt and on her return always entered the uncapped cell. Had the "widow-mother" lived, each cell would have contained a larva or an egg, and the worker wasps would have fed them. Following an instinctive tendency to feed the hungry babes that normally would occupy those cells, this wasp repeatedly entered those tenantless cells with food. It was a pathetic sight to watch the creature repeatedly and industriously attempting to perform an impossible instinctive function.

On the night of September the first a wasp emerged from one of the recently capped cells. Another emerged the following night, and in a few days wasps had emerged from all of the newly capped cells. While in the larval stage these wasps fasted from the seventh to the fifteenth of August. From the fifteenth to the nineteenth the only food they received was honey. From the nineteenth until the cells were capped they received the normal food of such larvæ. Yet these insects emerged in perfect form. This result was a surprise to me. Margaret Morley [1] fed four larvæ of a species of Polistes (she does not state which species) on maple sugar and raw egg. One of them died before weaving its cocoon; three wove cocoons that were thin and transparent, but none emerged from the cocoons. Of the three that constructed cocoons, one fell out and died and two died in the cells without developing their wings. Since she fed her wasps for three weeks they were probably much younger than mine when they lost their natural nurses.

[1] *Op. cit.*, pp. 177–181.

No conclusive evidence of paper making by these orphan wasps was obtained. When the nest was obtained there were several unfinished cells. These cells were never finished. On one occasion I thought I detected an addition to the rim of one of the cells containing the large larvæ; but since I had placed no mark on the cell I could not be certain. A day later the silken cap was placed on the cell. The upper extension of the wall of this cell seemed to be of paper; it was not so white as the top of the cap which was woven by the larvæ. To be sure that this portion was constructed of paper, I would have been forced to remove a piece of the wall; and I could not do that without disturbing the pupa within.

It is the first of October; for a week it has been cool enough for fire; this morning a slight frost is whitening the tops of the insectary. All but three of the wasps have disappeared, and those are resting, in a stupor, upon the top of the nest, awaiting an inevitable death.

Summary.

1. These workers of *Polistes pallipes* Lepel. which had never seen the widow-mother of the colony nor associated with any other wasps, performed all the activities of such wasps, except egg-laying and, possibly, paper-making.

2. The large larvæ that had nearly completed their larval period of life, after fasting for eight days, feeding on honey only for the next three days and receiving their normal diet for the remainder of their larval life, constructed perfect cocoons and emerged as normal imagoes. The small larvæ, when submitted to such hardships, died.

3. After being restricted to a honey diet for several days, these wasps became cannibals. Bit by bit, they removed the cap from a pupal cell, decapitated the inmate and ate the contents of its thorax.

4. From the first, these wasps were so tame that they would accept honey or insect larvæ when offered to them on glass rods, in forceps, or even upon my fingers.

5. Lepidopterous larvæ captured for food are not stung. Grasping the caterpillar with her fore feet, the wasp rotates it on its longitudinal axis and gradually elevates it while she malaxates its posterior end until her jaws are filled with a ball of pulpy matter. The remainder of the insect is then dropped.

NOTE ON THE FOLLOWING ARTICLE

Although the following article is written from a medical standpoint, it deals with a matter of practical importance to economic entomologists, and presents the first experimental data bearing on the hypothesis [1] that poliomyelitis (infantile paralysis) may be carried by *Stomoxys calcitrans*.

Since it appeared, Anderson and Frost[2] of the Public Health and Marine-Hospital Service have reported similarly successful results in transmitting poliomyelitis among monkeys, by repeating these same experiments with Stomoxys. They have further been able to induce the disease in a third monkey by inoculation with an emulsion of the spinal cord taken from a monkey that developed the disease after being bitten by infected flies, thus proving the diagnosis in the case of the fly-bitten monkeys. (Ed.)

SOME EXPERIMENTAL OBSERVATIONS UPON MONKEYS CONCERNING THE TRANSMISSION OF POLIOMYELITIS THROUGH THE AGENCY OF *STOMOXYS CALCITRANS*, A PRELIMINARY NOTE.[3]

By M. J. Rosenau,

Professor of Preventive Medicine aed Hygiene, Harvard Medical School,

and

Charles T. Brues,

Bussey Institution, Harvard University.

The work we are about to report was done for, and under, the auspices of the State Board of Health of Massachusetts.

We should like to have it distinctly understood, and therefore emphasize the fact right in the beginning, that this announcement is to be considered as a preliminary report, for the work is still

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[1] Brues, C. T. & P. A. E. Sheppard, The Possible Etiological Relation of Certain Biting Insects to the Spread of Infantile Paralysis. Month. Bull. State Board of Health of Massachusetts, Dec. 1911, pp. 338–340 and Journ. Econ. Entom., Vol 5, pp. 306–324 (Aug. 1912).

[2] Anderson, J. H. and Frost.

[3] Reprinted from the Monthly Bulletin of the State Board of Health of Massachusetts, Vol. 7, n. s., pp. 314–317. (September, 1912).

in progress. Certain results have been obtained which it seems advisable to announce at this juncture. In taking this action in announcing work before it is completed we have not assumed the sole responsibility, but have taken counsel with older and wiser heads, friends for whose judgment we have the highest regard.

When we first took up the study of this disease—infantile paralysis—with the State Board of Health of Massachusetts, we considered all possible modes of transference of the virus from the sick to the well, but gradually focussed our attention upon the fact that the disease seemed to be spread rather directly from person to person. In other words, the disease appeared to us at first blush to be a "contagious" disease, but one in which mild or abortive cases, missed cases, and third persons probably played an important rôle in the transfer of the infection. We were probably prejudiced in favor of this viewpoint on account of the splendid work of Wickman, whose publications we studied with care. We were further influenced to regard poliomyelitis as a "contagious" disease owing to the views of Flexner, who compared it to epidemic cerebro-spinal meningitis, and who regarded that it spread in the light of a contact infection through the secretions from the mouth and nose. The analogy to meningitis was a very close one, and the experimental fact that the virus could be demonstrated in the nasal mucosa of monkeys (Osgood Lucas and others) seems to corroborate the suspicion that we are in fact dealing with an infection spread very much as cerebro-spinal meningitis is spread.

If these assumptions were correct, then the virus should be demonstrable in the secretions from the nose and throat. Rosenau Sheppard and Amoss therefore injected 18 monkeys with the nasal and buccal secretions obtained from 18 persons who were suffering with the disease at the time, or in the stage of convalescence, or from persons suspected of acting as carriers. These results were negative. At the same time Straus of New York had a series of negative results, and other American workers were also unable to find the virus where we assumed it should be. These negative results seemed to us to have positive significance, and was the first definite indication that we were upon the wrong trail.

That poliomyelitis is not a "contagious" disease was clearly brought out by Dr. Richardson and other observers who have

spoken this morning,[1] all of whom have emphasized the point that the disease shows little or no tendency to spread in crowded districts, in schools, in institutions, in asylums, in camps and in other places where one would expect a disease spread by contact through secretions of the mouth and nose to spread most readily. We have in mind the fact that many cases of the disease have been brought into asylums and hospitals throughout the State of Massachusetts, in all stages of the infection; yet secondary cases have not occurred under such circumstances. On the contrary the disease prevailed in Massachusetts more particularly in rural and country districts sparsely settled.

Another reason that led us away from the theory of contacts, and made us believe that we were not dealing with a contagious disease in the ordinary sense of that term, was the close analogy between rabies and poliomyelitis. All investigators in laboratories who have worked with these two viruses have been struck with the similarity between rabies and poliomyelitis. Both viruses are diffused widely throughout the body, both exist in special concentration in the central nervous system, both are filterable, etc. Rabies being a wound infection made us conjecture that poliomyelitis may also be similarly transmitted.

Our experience with yellow fever, perhaps more than anything else, influenced us concerning the probable mode of transmission of poliomyelitis. It had been the privilege of one of us to work with yellow fever before and after the mosquito days, and many analogies came to mind which made us believe that poliomyelitis also was not a contagious disease.

All the various reasons that influenced us in turning from contagion to some other mode of transference need not engage our attention now, for the history of this part of the work has been ably and accurately given by Dr. Richardson in the paper which he has just read. In justice to Dr. Richardson we desire to state that all the essential conclusions of his paper were arrived at before he knew of the results in the laboratory with the monkeys.

The work which we now briefly desire to report consists in exposing monkeys during all stages of the disease to the bites of *Stomoxys calcitrans*. The monkeys were infected in the usual way

[1] Before the International Congress of Hygiene and Demography, at Washington, D. C. September 27, 1912.

by bringing an emulsion of a known virus obtained from human sources in direct association with the central nervous system. After the flies had had abundant opportunity to bite these infected monkeys during the various stages of the disease, including the period of incubation, healthy monkeys were then exposed to the bites of these same flies. Of 12 healthy monkeys indications of the disease have been obtained in 6, 3 of them in a virulent form, resulting in death, the other 3 with transient tremblings, partial paralysis, diarrhoea and recovery. It is interesting to note that several of the monkeys had diarrhoea, therein the disease resembles the human disease more closely than when monkeys are simply inoculated with the virus into the brain, for gastro-intestinal upsets in children are frequently associated with infantile paralysis.

In these experiments it is important, we think, to use the proper technic in order to obtain successful results. The flies should be handled as little as possible, It is much better to handle the monkeys and leave the flies alone. In our experiment the flies were caught in nature, some of them were bred, placed in a large cage about 6 feet long by 5 or 6 feet wide, and some 3 or 4 feet high. The monkeys are stretched out at full length and wrapped in chicken wire. In this way they can be placed in the cage and the flies have full opportunity to bite. The flies appear to need a feed of blood about every day or two. They sometimes visit water which is kept in the cage, but apparently cannot be induced to eat any other food than the blood. At least, in our experiments, bananas, fruits and other substances exposed apparently were little visited by the flies. Furthermore, in our experiments a very large number of flies were used.

In conclusion we desire simply to summarize the fact that we have apparently transferred the virus of poliomyelitis from monkey to monkey through the bite of the stable fly, *Stomoxys calcitrans*. We would like to emphasize the fact that this does not appear to be simply a mechanical transference, but rather a biological one, requiring a period of extrinsic incubation in the intermediate host.

What conclusions can we draw from these facts? At present it seems to us we would not be justified in drawing any conclusion —the significance of the facts if confirmed[1] is self-evident.

[1] As previously noted (p. 191), these experiments have been confirmed by Anderson and Frost.

"SUGARING" IN THE AUTUMN.

By Rudolf C. B. Bartsch,
Roslindale, Mass.

Of the many methods employed in collecting Lepidoptera there is none, which has been tried in this country, that has given poorer results than the so-called "sugaring." European collectors come here with tales of phenomenal luck in collecting moths by means of "sugar," especially members of the family Noctuidæ. Upon consulting Mr. William Reiff, I found that the methods of the German entomologists vary so greatly from those recommended by American authors that it seemed to me this must be the reason for the extraordinary results. Mr. Reiff agreed to accompany me and give this method a trial after I had explained to him my previous unsuccessful attempts to secure anything worth while by means of "sugar."

The first difference that I found was in the "sugar" used, and the second in the manner of applying to the trees. Holland, for instance, in his "Moth Book"[1] recommends on page 146, the following formula: 4 lbs. sugar, 1 bottle of stale beer and a little rum, to be placed in a bucket and applied to the trees with a whitewash brush. This mixture naturally gives a very thin solution and soaks readily into the bark of the trees, and since he recommends a whitewash brush it is supposed that he is desirous of covering a large area quickly. The formula given me by Mr. Reiff is as follows: 1 quart cheapest molasses, to which add about one half a bottle of stale beer and then boil until it nearly stiffens when dropped in cold water. Let it cool and then add about a wine-glass full of Jamaica rum. This mixture should be prepared some days in advance as aging seems to improve it. This "sugar" is enough for three trips and gives, each time, enough for from 40 to 50 trees. Just before using add to the mixture necessary for one night, 3 or 4 drops of amyl acetate. The method of applying to the trees is as follows: take a small round brush (about 1 inch diameter) and dip it into the sugar, then cover a space on the bark of the tree about the size of palm of the hand, working

[1] Holland, W. J., The Moth Book. New York: Doubleday, Page & Co., 1905.

the "sugar" well into the bark, and have it about the height of the shoulders from the ground. The "sugar" being very thick is not easily absorbed by the bark and trickles down very slowly.

The next and most important point is to select a proper place to "sugar." We first tried "sugaring" along the paths of a large wood-lot where the large trees had been thinned out until they were on an average about 10 feet apart. There was, however, very heavy underbrush. The results here were so discouraging that even Mr. Reiff was inclined to admit that "sugaring" in America seemed to be more or less a failure, but he maintained that the place was not ideal, so we hunted for a better spot. Finally we found at Concord, Massachusetts, a large woods in which about eight acres had been thinned out until the large trees were about 8 to 12 feet apart and without underbrush. This place was intersected by several well-worn paths and was surrounded on all sides by dense forest extending for a considerable distance in all directions. The trees have an average diameter of about 8 inches, and are mostly white and red oaks, with a few pines, birches, maples and hickories scattered here and there.

On September 14th we made our first attempt at this place and had such gratifying results that we have been "sugaring" there at least once a week since that time. On no trip have we secured less than fifty specimens each and on October 19th we each secured over 200 perfect specimens of about 30 different species. At all times we made it a point to apply the "sugar" to the trees right after sunset and then waited until it was quite dark (about 20 to 30 minutes after sugaring last tree), before we lighted our "Bulls-eye" lanterns. The lantern should be held carefully so that the rays of light shine steadily on the trees, for flitting lights and shadows scare the insects from the sugar. Another important point is to approach the sugar directly in front and not from one side. As you approach the tree it is well to notice carefully just what species are resting there, and then try to secure the new and rare specimens first, for at times it is possible to secure only very few of those that are sipping the sweets. Just what causes this restlessness of the insects at times we were unable to determine. October 12th and 19th were two almost identical days, both fairly warm (about 55° in the evening). On the 12th a very heavy fog hung over the land making it difficult at times to distinguish

objects more than 100 feet away, while on the 19th a heavy misty rain was falling, also shutting out the landscape. On both evenings shortly after dark a southwest wind sprung up, clearing the atmosphere and also bringing with it the moth of the "cotton worm," *Alabama argillacea* Hübner, which came freely to our "sugar."

The moths however acted very differently on these two days. On the 12th they rested very quietly on the "sugar" and were not disturbed very much by our approach, so that it was possible to take all the specimens we desired which were there. We were fortunate enough to secure over one hundred, each of us. On the 19th, however, the moths behaved very badly, and if they had not been ten times more numerous than previously I am afraid we would have caught very few of them. They seemed to be swarming about the "sugar" and on one tree I counted over fifty specimens, but I was able to secure less than a dozen on this tree. It was very exciting and interesting to collect as many as ten different species of Xylina, with a Catocala here and there, also several Scopelosoma and many other interesting insects. Besides the moths, we found two species of ants. (*Cremastogaster* sp., and *Lasius niger* var. *americanus*), some Ichneumonidæ and Vespidæ, Coleoptera (mostly Carabidæ Lampyridæ, also Tenebrionidæ), Orthoptera (*Diapheromera femorata* and *Gryllus pennsylvanicus*), Diptera and Myriapoda.

We found on all our trips that the first round of the trees yielded about 70 per cent of our catch, the second round about 25 per cent, and the third round only 5 per cent. Of course the second and third rounds yielded different species from the first, showing conclusively that certain species feed later than others and it is therefore advisable to make several trips in order to secure these different late feeding species. We made a later attempt on the 26th of October after three days of heavy rainfall and found that the moths came quite freely to the "sugar," but only the more common and more numerous species, showing that the rain in all probability had killed them in large numbers or that they were still too weak to fly.

These "sugaring" experiments also gave us some data as to the length of the flying period of some of the Catocalas. We had taken *Catocala amica* f. *nerissa*, Hy. Edw., in the middle of July

on the trees in the daytime and found it as late as October 5th on the "sugar." *Catocala concumbens*, Walk., we found the first week in August and as late as the 19th of October, *Catocala cara*, Guen., from the middle of August to the 26th October; *Catocala relicta* f. *phrynia* middle of August to 12th of October; *Catocala antinympha*, Hübn., the middle of July to the first week of October. From these data we decided that the flying period is at the least two and one-half months long.

The following is a list of the species taken which we have so far identified:

Noctuidae.

Caradrina multifera Walker.
Oligia grata Hübner.
Hyppa xylinoides Guenée.
Euplexia lucipara Linnæus.
Actinotia ramosula Guenée.
Pyrophila pyramidoides Guenée.
Heliotropha reniformis Grote.
Prodenia ornithogalli Guenée.
" *eudiopta* Guenée.
Laphyma frugiperda Abbot & Smith.
Ryhnchagrotis rufipectus Morrison.
" *placida* Grote.
" *minimalis* Grote.
Adelphagrotis prasina Fabricius.
Semiphora elimata f. janualis Grote.
Agrotis badinodis Grote.
" *ypsilon* Rottemburg.
Peridroma margaritosa Haworth.
" " f. *saucia* Hübner.
Noctua bicarnea Guenée.
" *c-nigum* Linnæus.
" *plecta* Linnæus.
" *lubricanus* Guenée.
Euxoa messoria Harris.
Anytus privatus Walker.
Mamestra trifolii Rottemburg.
" *renigera* Stephens.
Heliophila unipuncta Haworth.
" *albilinea* Hübner.
" *multilinea* Walker.
Lithomoia germana Morrison.
Xylina disposita Morrison.
Xylina innominata Smith.
" *laticinerea* Grote.
" *grotei* Riley.
" *antennata* Walker.
" *tepida* Grote.
" *baileyi* Grote.
" *pexata* Grote.
" *thaxteri* Grote.
" *petulca* Grote.
" *capax* Grote & Robinson
" *unimoda* Lintner.
Calocampa nupera Lintner.
" *curvimacula* Morrison.
Jodia rufago Hübner.
Eucirrædia pampina Guenée.
Scoliopteryx libatrix Linnæus.
Orthosia bicoloraga Guenée.
" *helva* Grote.
Scopelosoma moffatiana Grote.
" *walkeri* Grote.
Glœa inulta Grote.
" *sericea* Morrison.
" *viatica* Grote.
Epiglœa pastillicans Morrison.
" *declira* Grote.
Alabama argillacea Hübner.
Eustrotia apicosa Haworth.
Drasteria crassiuscula Haworth.
Catocala insolabilis Guenée.
" *tristis* Edwards.
" *relicta* Walker.
" " f. *phrynia* Hy. Edwards.

Catocala cara Guenée.
" *amatrix* Hübner.
" *concumbens* Walker.
" *groteiana* Bailey.
" *ultronia* Hübner.
" *ilia* f. *uxor* Guenée.
" *ilia* f. *osculata* Hulst.
" *antinympha* Hübner.
" *badia* Grote & Robinson.
" *amica* f. *nerissa* Hy. Edwards.
Euparthenos nubilis Hübner.
Parallelia bistriaris Hübner.
Homoptera lunata (*edusa*) Drury.
Eipzeuxis americalis Guenée.
" *lubricalis* Geyer.
" *denticulalis* Harvey.
" *scobialis* Grote.
Plathypena scabra Fabricius.
Hypena humuli Harris.

And about 30 to 40 species as yet unidentified.

Geometridae.

Hydriomena latirupta Walker.
" " var.

About a dozen species of the so-called micro-Lepidoptera.

LIMOSINA MIRABILIS COLLIN, A SPECIES OF BORBORIDÆ NEW TO THE UNITED STATES.

By J. R. Malloch and F. Knab,
U. S. National Museum, Washington, D. C.

Fig. 1. Hind leg of *Limosina mirabilis* Collin.

Amongst a miscellaneous lot of Diptera collected at Veitch, Va., on June 9, 1912, there were three specimens of an interesting Borborid. It was originally described by J. E. Collins (Ent. Month. Mag., Vol. 13, 2d ser., p. 59, figs. 5, 6, 1902), from specimens taken by G. H. Verrall at Newmarket, England, and recorded also from Kirtling, England in the same paper. The remarkable thorn on the hind tibia present in both sexes (see fig. 1) readily distinguishes it from any other described species of the genus Limosina. The wing has the second and third costal divisions sub-equal.

NOTES ON THE LIFE-HISTORY OF *CORETHRA ALBIPES* JOHANNSEN.[1]

By C. H. Richardson, Jr.

Early in August 1912, a number of larvæ of *Corethra albipes* Johannsen together with those of *Anopheles punctipennis* Say, *Ochlerotatus sylvestris* Theobald and *Ablabesmyia dyari* Coquillett were collected in a small pool at Forest Hills, Mass. These were kept in the laboratory for more than a month, observations being made upon them from time to time, with a view to rearing the imagoes, the male of which has not hitherto been described, as well as to gather any facts of interest concerning the biology of this species.

Corethra albipes was described by Johannsen[2] in 1903 from a single female specimen obtained at Ithaca, N. Y., during August 1903. Since that time no additional specimens have been mentioned in literature, and it was therefore with considerable interest that the species was again secured at Forest Hills.

When full grown the larva of this fly is between 9 and 12 mm. in length, colorless, except for the large black eyes, the black posterior eye-spot, the two pairs of silvery air-sacs, covered dorsally with large black spots, and the brown-tipped mandibles. Often, too, the digestive tract is conspicuous as a brownish or greenish tube with several enlargements and constrictions.

In general structure the larva resembles that of *Corethra plumicornis* var. *americana* Johannsen[3] from which it differs in a number of details. There are four long bristles of equal length on the distal end of each antenna as described for *americana*, and in addition another short one slightly more than one half as long as the others (see fig. 1). Posteriorly from the antennæ, are the filaments of the third metamere of Meinert, five on either side of the median line; back of these the paired transparent appendages of the third metamere of Meinert with serrated outer margins.

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[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, 63.

[2] N. Y. State Museum Bull. 68, 1903, p. 398, pl. 39, fig. 11.

[3] *Loc. cit.* pp. 395–397, pl. 39, figs. 1–10.

The labrum is a large papilliform organ with two groups of about twenty stout hairs at the distal end, and a single bristle on either side about one third the length of the labrum above the distal end. Between the labrum and the mandibles and above the latter are the paired fans, each composed of nine long coarse hairs. There

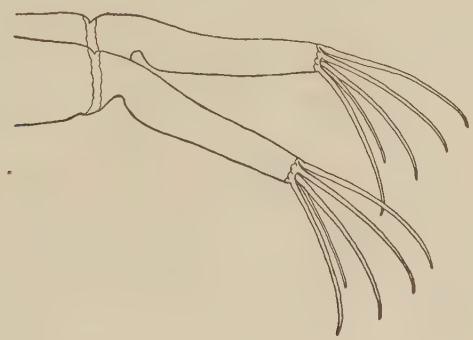

Fig. 1. Antennæ of *Corethra albipes* Johannsen.

are from 18 to 22 such hairs on the fans of *americana* according to Johannsen. The mandibles consist of a group of about four, large, brown chitinized teeth, the last with a serrated posterior margin; above the teeth and on the anterior surface of the mandibles are two spines. The maxillæ are fleshy lobes each with one anterior long jointed appendage, one median short stout spine and a smaller posterior spine. The labium possesses two short spines of equal length.

The two pairs of air sacs are situated in the thorax and in the seventh abdominal segment respectively as in *C. plumicornis* var. *americana* Johannsen. Their dorsal surface is covered by large pigmented cells with large nuclei which appear as hyaline spots in the darker medium.

The caudal appendages are as follows: a ventral comb of twenty long, plumose hairs; Johannsen gives twenty-five such hairs for *americana*; four elongate blood-gills on the apex of the caudal segment; above these four plumose apical hairs, the dorsal pair longer than the ventral; about twelve short, apical hooks situated between the ventral comb and the blood gills, each with

a serrated blade directed posteriorly; below the apical hooks is a pair of large hooks, curved forward.

The food of the larva appears to consist largely of unicellular organisms taken into the mouth without any apparent selection. Microscopic examination of the contents of the alimentary canal showed a quantity of such brown organisms and a smaller number of some sort of an alga. Three Copepods were found in the proventriculus of one specimen.

The pupa does not differ from *americana* except in color, the abdomen being quite colorless while the dorsum of the head and thorax is yellowish brown and the lateral and ventral surfaces dull white.

The transformation from the pupa to the imago took place in the aquarium after approximately sixty hours, the adult issuing through an irregular aperture in the dorsum of the thorax.

The following description of the male is taken from freshly emerged specimens:

Corethra albipes Johannsen. (male)

Basal joint of antennæ pale red, succeeding joints pale yellow with black bases; antennal hairs light yellow, upper surface of proboscis and palpi fuscous; incisures of palpal joints not lighter; cheeks yellowish white; ocellar space brown. Ventral surface of proboscis fuscous. Thorax pale brown dorsally with three reddish brown longitudinal stripes, the median stripe with a piceous median line and piceous lateral borders, the lateral stripes with piceous lateral borders only; the median stripe is produced anteriorly and abbreviated posteriorly, the lateral stripes are abbreviated anteriorly and produced posteriorly; pluræ dull white with a pale brown suffusion, spotted with piceous; scutellum pale brown with a black median line and an irregular black spot on each lateral angle; metathorax pale brown, peppered with darker spots. Ventral surface of thorax yellowish white. First and last abdominal segments smallest, others nearly equal; ground color of dorsal surface pale yellow marked with piceous, the markings being heaviest on the anterior part of the segments; sometimes a more or less well-defined anterior median spot and a darker anterior lateral spot on each segment. Hypopygium consisting of two jointed hooks, dark brown in color and about as long as the last abdominal segment. Ventral surface of abdomen with an irregular black spot on either side of the median line. Legs pale yellow, the last three tarsal joints darkened. Wings pale yellow, the veins clothed with long yellow hair; hair is also present on the wing margins, reaching its greatest development on the posterior margin; hair on posterior margin in two rows, one about half the length of the other; longest row composed of very wide hairs (see fig. 2 ; 1). Halteres white. Length of two specimens 7 mm. and 6.5 mm.

The female is larger, lacks the bands on the antennæ and has *less distinct* markings on the abdomen. (Fig. 2; 2 shows the wing of the female.)

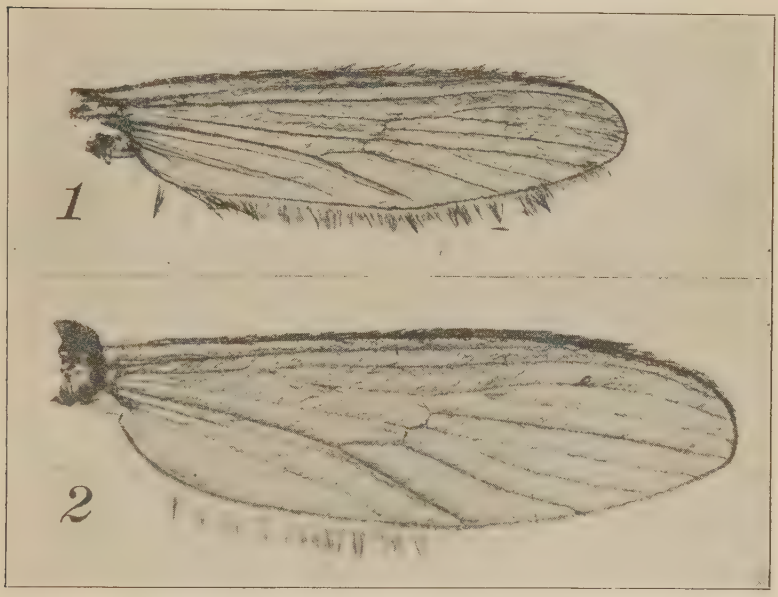

Fig. 2. Wings of *Corethra albipes* Johannsen. 1, Wing of male, enlarged 17 times; 2, Wing of female, enlarged 23 times.

A NEW MELITTOBIA FROM QUEENSLAND, AUSTRALIA.

By A. A. Girault,
Nelson (Cairns), North Queensland.

Melittobia australica, nov.

Normal position.

Female:—Length, 1.1 mm.; usual in size for the genus. General color dark brown-black, including the antennæ; proximal two thirds of abdomen lighter, greyish yellow; legs yellow, the coxæ and femora washed with dilute dusky; venation grayish; fore

wings lightly, uniformly, fumated throughout, the posterior wings hyaline. Eyes dark red. Distal tarsal joint not darker than the rest of the tarsus. Fore and posterior wings densely, uniformly ciliate in the disk, the marginal cilia of the fore wings short, those of the posterior wings nearly twice longer yet the longest here (middle of caudal margin) are not longer than a fourth of the blade's greatest width (across apex of the venation); they are moderately short. The fore wings are about two and a quarter times longer than wide. Stigmal vein distinct; postmarginal vein absent; other veins normal. The posterior wings bear about twelve lines of discal ciliation across its widest part. Two distinct parallel lines of discal cilia in the fore wing run along the caudal margin opposite the venation, while beneath the slender portion of the submarginal vein are two short lines of minute cilia, one on each side of the base of the cephalic of the two long lines just noted. Posterior wings broad. Distal joint of tarsi longest of the four. Parapsidal furrows complete, long; the keystone-shaped (cuneate) mesoscutum starred with minute white setigerous dots, also present on the parapsides but absent elsewhere. Scutellum regularly rectangular, longer than wide. Abdomen sessile, ovipositor not exserted, long. Abdomen ovate, clothed with paired rows of minute setae. Antennæ 9-jointed scape, pedicel, 1 ring-joint, 3-jointed funicle and 3-jointed club; subclavate. Scape normal, slightly compressed, only moderate in length; pedicel obconic, somewhat longer than any of the following joints; ring-joint very short, like a lamella; funicle joints 2 and 3 subequal, slightly wider than long, 1 subquadrate, slightly longer than wide; club cylindrical-ovate, its proximal two joints slightly wider than long, each larger than any of the funicle joints, more than thrice the size of the small apical joint which is conical and terminates in a stout, spur-like seta arising from its center. Funicle and club joints bearing, as seen from any single aspect, several conspicuous, oblique white sulci. Vertex sparsely pubescent.

Male:—Length 1.25 mm.; somewhat more robust than the other sex. Entirely different in color and in certain structures. General color light honey yellow, contrasting with the female; only the dorsal aspect of the abdomen, the femora, the distal tarsal joint and the antennal scape darker, nearly fuscous, the

antennal flagellum, however, greyish black; venation greyish brown, the fore wings uniformly, rather lightly, fumated throughout. Differing from the female in the following characters: the fore wings are perfect but very small and the stigmal vein is absent; the posterior wings are reduced in proportion. The tibial spur is lengthened, especially on the caudal legs; the antennæ are more compact, the scape enormously enlarged, but the appendage is 9-jointed if a ring-joint is present, which I doubt; the pedicel is short and attached to the inner side of the scooplike portion of the scape and is wider than long; all funicle joints wider than long, the first short, transverse, not a third of the length of either the second or third, which are subequal and large; club as in the female, but it is somewhat more compact and the terminal spur is just traceable as a nipple-like projection from the apex. Body subhispid, the pubescence especially noticeable over the whole abdomen and on the antennal scape; sulci on flagellum reduced and present on the club joints only. Fore wing bearing about eight lines of discal ciliation; its marginal cilia are short.

Described from three males and ten females received for identificaton from Mr. Henry Tryon, Government Entomologist and Vegetable Pathologist, Department of Agriculture and Stock, Brisbane, mounted in balsam on two slides labelled, "Host, *Pison spinolæ* (Hym.) Mt. Tambourine, S. Queensland, Dept. Ag. & S., 11; 12; 11."

Types: No. *Hy. 997*, Queensland Museum, Brisbane, two males, seven females on a single slide in balsam. *Cotypes*—One male, three females on a single balsam slide deposited in the collection of the Department of Agriculture and Stock, Brisbane.

Mr. Tryon informs me that the parasites emerged from the host in its cocoon but not until after it had transformed into the adult; the latter died. A number of the parasitic larvæ make their way out from each Pison and pupate nakedly.

This Melittobia, the first known from Australia, differs from a North American species as yet not identified but which is parasitic on the larva of *Sceliphorn cementarium*, the common mud dauber of the United States, in a number of specific characters, all distinct but none marked. The shape of the antennal joints differs, the coloration and the pubescence or ciliation of the wings. I could not discover a ring-joint in the male of the American species either and have reason to think it is absent.

THE MALE OF *ECITON VAGANS* OLIVIER.

By William Morton Wheeler,

Bussey Institution, Harvard University.

Only the worker form of *Eciton vagans* is known, although it was first described by Olivier as long ago as 1791 and is one of the most abundant and conspicuous legionary ants of tropical America from Mexico to Southern Brazil. That its female has never been seen is not surprising, because female Ecitons are among the rarest of insects, but it is strange that the male of such a common insect should not have been described as one of the numerous species of *Labidus*, a genus to which all male Ecitons were referred by Latreille, Westwood and other entomologists of the first half of the nineteenth century. The only described male, however, that may prove to belong to *E. vagans*, is *E. dubitatum* Emery (*vide infra*), but this is by no means certain.

November 29, 1911, while collecting ants at La Sabana, a suburb of San José, Costa Rica, I came upon a small army of *E. vagans* rapidly ascending the grassy slope of a ravine. While I was watching the rust-red workers a large chocolate brown male with infuscated wings came marching along in the file, and a few moments later another appeared alternately flitting and walking in the grass about a foot away from its worker companions but moving in the same direction. There could be no doubt that these two insects were accompanying the army and that they belonged to the same species as the workers, because the most careful search revealed no other Ecitons on the whole grassy slope of several acres. Moreover, it was not the regular season for forays of these ants, for I encountered very few species of the genus in Panama, Costa Rica and Guatemala during November, December and January. Only *E. cœcum* Latr., which is a subterranean species, seems not to interrupt its forays during these months. I append a description of the two males which I captured.

Eciton vagans Olivier.

Male. Length 15–16 mm.

Head transverse, nearly twice as broad as long, very nearly as broad as the thorax; broadly arcuate behind, its anterior border broadly and arcuately excised. Eyes and ocelli rather small, the former less convex than in many species. Frontal carinæ very short, not carried up on the front or curving outward behind the antennal insertions. Mandibles long, as long as the transverse diameter of the head, flat, straight and with subparallel borders, except at the tip, which is curved and pointed, with a single large, triangular tooth about 2–3 the distance from the base to the tip. Antennæ rather slender, first funicular joint not more than half as long as the second. Thorax only moderately convex above, not overarching and concealing the head when the insect is seen from above. Mesonotum with distinct parapsidal and median longitudinal furrows. Scutellum and metanotum very convex, each longitudinally impressed in the middle. Epinotum abruptly sloping, with a blunt transverse protuberance on each side. Petiole twice as broad as long, much narrower in front than behind, deeply concave in the middle above, with prominent anterior and posterior angles, the latter projecting considerably. Gaster rather short and thick. Hypopygium terminating behind in two claw-like teeth. Hind legs long, the tips of their femora surpassing the posterior border of the second gastric segment. Claws of tarsi not dentate as in the worker.

Mandibles, head, thorax, antennæ and legs opaque, very finely and densely punctate; mandibles, head and mesonotum also with more scattered, coarser, piligerous punctures. Petiole and gaster shining, finely shagreened.

Hairs fulvous; long only on the posterior surfaces of the fore coxæ and femora, on the mandibles, head and anterior border of the scutellum; short, subreclinate and denser on the mesonotum, tip of gaster, posterior corners of petiole and ventral surfaces of middle coxæ; absent on the pronotum and pleuræ. Antennal scapes, petiole and gaster with only very short and delicate pubescence which is not sufficiently dense to conceal the surface.

Mandibles, head, scapes, thorax, petiole and gaster dark chocolate brown; funiculi, tarsi and tibiæ light yellowish brown; femora darker. Wings rather deeply infuscated, with resin-brown veins and stigma.

This form agrees in many particulars with the description of *E. dubitatum* Emery from Paraguay (Bull. Soc. Ent. Ital. XXVIII, 1896, p. 8). The shape of the mandibles is the same as is evident from comparison with Emery's figure, but there are numerous differences in sculpture, pilosity and coloration. Emery believed that his *dubitatum* might be the male of *E. vagans* Oliv. or of *E. rogeri* Dalla Torre, but in his latest contribution (Genera Insect. Dorylinæ, p. 20) he cites it only as the possible male of the latter species.

NOTE ON *TRICRANIA SANGUINIPENNIS* SAY (COLEOPTERA).

By C. A. Frost,
Framingham, Mass.

On March 30, 1912, a large number of bees were noticed flying about a sunny bank in a shallow cut on the line of the Boston Water Works Conduit in the Town of Sherborn. It was in a run out and sandy pasture where the burrows could easily be seen amid the sparse grass by the white sand thrown out in digging. The bees were flying about very actively close to the ground, occasionally alighting and entering the burrows.

As I stood watching them I noticed a number of red insects scattered about; these proved to be *Tricrania* and in a few minutes I picked up thirty-two males and thirteen females of this interesting genus. They were found only on the east end of the bank, overlapping but very little the area occupied by the bee burrows and toward the west, from which direction a strong wind was blowing. None at all were found where the holes and bees were most abundant.

The beetles were crawling about quite actively, but I did not see any in copulation nor any evidences of eggs. A few adults were found beneath dry cow dung and one beneath a small stone. Only a few were seen in close proximity to any of the holes, and none of the bees were seen to molest them.

Specimens of the bees were sent to Mr. John H. Lovell of Waldoboro, Maine, who kindly identified them as *Colletes compactus* Cress.

CORRECTION

In the paper on "Mites Associated with the Oyster-Shell Scale" by H. E. Ewing and F. L. Webster in Psyche, Aug, 1912, Figure 2, p. 128 is incorrectly named. This mite is *Monieziella entomophaga* Lab.—Editor.

The Index and Title page to Vol. 19 will appear as a supplement to the February, 1913, issue.

PSYCHE.

INDEX TO VOL. XIX, 1912.

INDEX TO AUTHORS.

Alexander, 63, 162.
Banks, N., 97.
Barnes, W., 14.
Bartsch, R. C. B., 195.
Bickhardt, H., 97.
Blackman, M. W., 92.
Brues, C. T., 135, 191.
Cockerell, T. D. A., 41, 105.
Caudell, A. N., 12, 160.
Davis, W. T., 20, 91.
Emerton, J. H., 25, 134.
Ewing, H. E., 121.
Fall, H. C., 9.
Frost, C. A., 208.
Girault, A. A., 203.
Glaser, R. W., 159.
Hood, J. D., 113.
Johnson, C. W., 1, 102, 108, 181.
Kershaw, J. C., 77.
Knab, F., 106.
Mann, W. M., 36, 98, 118, 145.
Matausch, I., 66.
McDunnough, 14.
Muir, F., 77.
Paine, J. H., 139.
Patch, E. M., 5.
Rau, P., 69.
Richardson, C. H., Jr., 200.
Rosenau, M. J., 191.
Shaeffer, C., 104, 147.
Turner, C. H., 100, 137, 184.
Webster, F. L., 121.
Wheeler, W. M., 90, 172, 206.
Wolcott, A. B., 71.

INDEX TO SUBJECTS.

(New species and new names in boldface type.)

Ablabesmyia dyari, 200.
Acarus malus, 125.
Actias luna, var *dictynna*, 91.
Ammophila abbreviata, 137.
Ancyloscelis, 58.
Ancyloscelis riparia, 58.
Anochetus emarginatus, 38.
Anopheles punctipennis, 200.
Anthidium pymœum, 46.
Anthophora marginata, 106.
Ants, parabiosis in, 36.
Anystis agilis, 129.
Aphænogaster subterraneous, 11.
Aphænogaster subterranea, 10.
Aphiochæta enderleini, 135.
Aphiochæta epeiræ, 135.
Aphiochæta fumipennis, 136.
Aphiochæta ferruginea, 136.
Aphiochæta ferruginosa, 136.
Aphiochæta juli, 136.
Aphiochæta longifrons, 135.
Aphiochæta minor, 136.
Aphiochæta minuta, 135.
Aphiochæta umbripennis, 136.
Aphiochæta xantippe, 136.

Batrisus aphænogastri, 11.
Bdella cardinalis, 129.
Bees from Brazil, 41.
Bees from Guatemala, 105.
Bombus unifasciatus, 106.
Brachyacantha manni, 150.
Brazil, bees from, 41.
Brazil, Buprestidæ from, 118.
Brazil, Cleridæ from, 71.
Brazil, Coccinellidæ from, 149.
Brazil, Histeridæ from, 118.
Brazil, sawfly from, 62.
Brazil, Temnochilidæ from, 147.
Brazilian ants, parabiosis in, 36.
Buprestidæ from Brazil, 118.

Cœnonomada bruneri, 52.
Cœnonomada pluricincta, 53.
Cœnonomada tertia, 52.
Caloderma, 12.
Camponotus fulvopilosus, 90.
Cataglyphis, 172.
Centris ænea, 60.
Centris bakeri, 42.
Centris bicornuta, 45.
Centris birkmanni, 45.
Centris ceraocephala, 45.
Centris hæmorrhoidalis, 43.
Centris heterodonta, 43.
Centris lanipes, 60.
Centris libertatis, 44.
Centris maculata, 60.
Centris manni, 47.
Centris nitida, 45.
Centris tarsata, 48, 61.
Centris versicolor, 43.

Ceratina chrysocephala, 46.
Ceratina cupreiventris, 46.
Ceratina gossypii, 47.
Ceratina longiceps, 46.
Ceratina lucidula, 47.
Ceratina minima, 47.
Ceratina nautlana, 47.
Ceraturgus similis, 152.
Chacoana, 53.
Chalybion cæruleum, 136.
Chionea valga, 102.
Cholomyia inæquipes, 102.
Cholomyia longipes, 102.
Chrysopilus connexus, 108.
Chrysopilus davisi, 4.
Chrysopilus, velutinous species of, 108.
Cicada, nymphal head of, 82.
Cleridæ from Brazil, 71.
Coccinella undecimpunctata, 104.
Coccinellidæ from Brazil, 148.
Cœlioxys agilis, 52.
Cœlioxys ardescens, 51.
Cœlioxys edentata, 51.
Cœlioxys lævigata, 51.
Cœlioxys otomita, 52.
Cœlioxys rufipicta, 52.
Cœlioxys simillima, 52.
Colletes compactus, 208.
Combophora beski, 146.
Conoprosopa scutellata, 135.
Copulation of *Ammophila abbreviata*, 137.
Corethra albipes, 200.
Coryptilomyia armigera, 135.
Crane fly from Porto Rico, 63.
Cremastogaster, 36.
Currant fly, 139.
Cylindrotomia americana, 1.
Cylindrotomia anomala, 1, 2.
Cylindrotomia distinctissima, 1.
Cylindrotomia juncta, 1.
Cylindrotomia splendens, 1.
Cylindrotomia tarsalis, 1, 2.
Cyta brevipalpa, 129.

Dasiapis, 58.
Diadasia, 58.
Diadasia diminuta, 58.
Diadasia facialis, 59.
Diadasia murihirta, 59.
Diadasia parahybensis, 58.
Diadasia sumichrasti, 59.
Diadasia sumichrasti subsp. vulpihirta, 59.
Dianthidium gregarium, 46.
Dianthidium heathi, 45.
Dipedia, 58.
Diptera, new species of, 151.
Diraphia maculipennis, 6.
Diraphia vernalis, 7.
Dolichoderus bispinosus, 36.
Dolichoderus debilis, var. *rufescens*, 40.
Dolichoderus lugens, 37.
Dolichopezini, key to genera of, 64.
Drosophila repleta, 106.
Dyspteris abortivaria, 14.

Eciton dubitatum, 206.
Eciton hamatum, guest of, 98.
Eciton vagans, male of, 206.
Ectropis crepuscularia, 17.
Eggs of *Samia cecropia*, period of incubation of, 69.
Elliptera alexanderi, 3.
Elliptera astigmatica, 164.
Emesidæ, new species of, 97.
Enoclerus deliciolus, 73.
Enoclerus inimicus, 72.
Enoclerus lugubris, 72.
Entomological Society of America, 22.
Entomology, International Congress of, 22.
Epicharis unicalcarata, 53.
Epigrypa brevicornis, 12.
Epiphlœus bakeri, 74.
Epiphlœus iracundus, 74.
Epochra canadensis, 139.
Eriocera albihirta, 167.
Eriocera cinerea, 169.
Eriocera fultonensis, 168.
Erioptera distincta, 165.
Euglossa cordata, 61.
Eulæma dimidiata, 61.
Eulæma manni, 41.
Eulæma mussitans, 42, 106.
Eulæma superba, 42.
Eucymatoge intestinata, 14.
Eupalus, 130.
Euparyphus greylockensis, 5.
Eupithecia, 14.
Eupithecia miserulata, 15.
Exomalopsis, 57.
Exomalopsis paraguayensis, subsp., manni, 56.
Exoplectra brasiliensis, 151.

Formica crinita, 90.
Formica criniventris, 90.
Formica flammiventris, 90.
Formica fusca argentata, 90.
Formica fusca, var. argentea, 90.
Formica lasioides var. *picea*, 90.
Formica lasioides var. vetula, 90.
Formica, new names for some species of, 90.
Formica pallidefulva subsp. schaufussi, var. dolosa, 90.

Formica pallidefulva subsp. *schaufussi*, var. *meridionalis*, 90.
Formica rufa rubiginosa, 90.
Formica rufa subsp. aggerans, 90.
Formica rufibarbis var. *occidentalis*, 90.
Formica rufibarbis var. occidua, 90.
Formica rufiventris, 90.
Formica sexspinosus, 90.

Geolycosa, 25.
Glyptothrips, 116.
Glyptothrips flavescens, 116.
Gonatista grisea, 161.
Gonatista major, 161.
Gonatista, notes on the Mantid genus, 160.
Gonatista phryganoides, 162.
Gonatista reticulata, 161.
Gooseberry fruit fly, 139.
Guatemala, bees from, 105.

Hæmatopota, North American Species of 181.

Hæmatopota punctulata, 182.
Hæmatopota rara, 182.
Heliothrips phaseoli, 113.
Hemisia, 42.
Hemisia, key to species from Brazil, 43.
Hemisarcopetes malus, 124.
Histeridæ from Brazil, 118.
Homoptera, development of mouth-parts in, 77.
Housefly in relation to city garbage, 156.

Lepidosaphes ulmi, mites associated with, 121.
Leptergatis wheeleri, 105.
Leptis gracilis, 3.
Leptometria, 58.
Leptomidas desideratus, 151.
Liometophilus, 9.
Liometophilus manni, 10.
Liometopum apiculatum, 10.
Limnobia argenteceps, 163.
Limnophila laricicola, 167.
Limosina mirabilis, 199.
Livia, 5.
Livia bifasciata, 6.
Livia maculipennis, 6.
Livia marginata, 8.
Livia saltatrix, 7.
Livia vernalis, 6.
Lophioderus arcifer, 11.
Lophioderus biformis, 11.
Lophioderus gracilis, 11.
Lophioderus myops, 11.
Lophioderus ovipennis, 10.
Lucustid, notes on a pink, 159.
Luna, red margined, 91.
Lycosa arenicola, 29.
Lycosa domifex, 33.
Lycosa fatifera, 33.
Lycosa, Four burrowing, 25.
Lycosa missouriensis, 33.
Lycosa nidifex, 29, 31.
Lycosa pikei, 29.
Lycosa wrightii, 34.

Mailing insects, postal regulations concerning, 109.
Manaos, 62.
Manaos nigronotatus, 62.
Megachile bidentis, 56.
Megachile chrysopila, 55.
Megachile constructrix, 55.
Megachile deceptrix, 55.
Megachile lenticula, 54, 61.
Megachile microsoma, 55, 56.
Megachile nudiventris, 54.
Megachile permunda, 56.
Megachile pilosa, 56.
Megachile schrottkyi, 55.
Megachile verœcrucis, 56.
Megachile virescens, 55.
Megistomastix, 63.
Megistomastix portoricensis, 64, 65.
Melanetærius infernalis, 97.
Melaloncha pulchella, 136.
Melanocentris fuscata, 44.
Melanocentris fusciventris, 44.
Melanoplus femur-rubrum, supernumerary median ocellus in, 92.
Melipona abunensis, 48.
Melipona fulva, 48.
Melipona mandacia, 48.
Melipona mixta, 48.
Melipona pseudocentris, 47.
Melipona rufiventris, 47.
Melissa decorata, 61.
Melittobia australica, 203.
Membracid, protective adaptation in, 145.
Mesocyphona distincta, 165.
Metanema determinata, 18.
Metanema quercivoraria, 19.
Metopotropis herero, 135.
Micoutalis calva, observations on, 66.
Milyas, 20.
Mimopria ecitonophila, 98.
Mites associated with Oyster-shell Scale, 121.
Monieziella angusta, 125.
Monieziella entomophaga, 125, 130.
Moths, list of, taken at sugar, 198.
Mouthparts, development of, in Homoptera, 77.

Musca domestica, 157.
Muscina stabulans, 156.
Myrma sexspinosa, 90.
Myrmecocystus, 172.
Myrmecocystus melliger, 174.
Myrmecocystus melliger lugubris, 176.
Myrmecocystus melliger lomaënsis, 175.
Myrmecocystus melliger mimicus, 176.
Myrmecocystus melliger orbiceps, 175.
Myrmecocystus melliger semirufus, 176.
Myrmecocystus mexicanus, 176.
Myrmecocystus mexicanus hortideorum, 178.
Myrmecocystus mexicanus mojave, 179.
Myrmecocystus mexicanus navajo, 179.
Myrmecocystus, table of species, 173.
Myrmecocystus yuma, 176.
Myrmecocystus yuma flaviceps, 177.
Myrmecophile, 98.
Myrmecophilous Coleoptera, 9.
Myrmeleon immaculatus, 134.

Necrobia rufipes, 77.
Nemotelus bonnarius, 4.
New Nearctic Tipulidæ, 163.
Nicocles politus, 153.
North American Diptera, 1.
North American Thysanoptera, 113.

Ocellus, supernumerary in *Melanoplus femur-rubrum*, 92.
Ochlerotatus sylvestris, 200.
Odontomachus, 38.
Odontomachus affinis panamaënsis, 40.
Odontomachus affinis, subsp. **mayi**, 39.
Ophrynopus batesianus, 63.
Ophrynopus fulvistigmus, 63.
Oribata, 133.
Orsodachna atra, variations of, 153.
Oyster-shell scale, mites associated with, 121.

Pactothrips flavescens, 116.
Parabiosis in ants, 36.
Paraphyto opaca, 103.
Percnoptilota fluviata, 16.
Pero honestarius, 14.
Peru, Proscopiid from, 12.
Phalacrotophora, 135.
Phormia regina, 157.
Phalacrotophora epeirœ, 135.
Phalacrotophora longifrons, 135.
Phoridæ, Synonymical notes on, 135.
Phyllobænus manni, 73.
Pink locustid, 159.
Plastophora, 136.
Platymedon, 12.
Ploiariodes hirtipes, 97.
Poliomyelitis, transmission of, 191.
Polistes pallipes, orphan colony of, 184.
Polyrachis sexspinosa, 90.
Porto Rico, Crane fly from, 63.
Promachus fitchii, 153.
Proscopiid Grasshopper, 12.
Psænythia burmeisteri, 54.
Psænythia canina, 54.
Psænythia philanthoides, 54.
Psænythia picta, 54.
Pselliopus barberi, 21.
Psyllidæ, 5.
Ptilopus, 43, 44.
Pyticera flavicollis, 76.

Review: Beiträge zur Kentniss der südamerikanischen Dipteren—Fauna, 183.
Review: Butterfly Hunting in Many Lands, 110.
Review: Guide to the Insects of Connecticut, 110.
Ryagioletis ribicola, 139.
Rhaphidolabis neomexicana, 170.
Samia cecropia, period of incubation of eggs of, 69.
Sawfly from Brazil, 62.
Sayomyia albipes, 200.
Scaptocosa, 25.
Sciagraphia mellistrigata, 14.
Sericocera gibba, 62.
Siphanta acuta, head of, 84.
Siphanta, observations on embryo of, 77.
Sphex, habits of, 100.
Sphex overcoming obstacles, correction, 136.
Stomoxys calcitrans, 191.
"Sugaring" in the autumn, 195.

Tapinotaspis heathi, 57.
Teleutemnestra, 58.
Temnochila chalcea, 147.
Temnochilidæ from Brazil, 147.
Tenebrioides bipustulata var. *impressifrons*, 148.
Tenebrioides bipustulata, 147.
Tenebrioides subcostata, 148.
Tenebrioides vittata, 148.
Terapus mnizechi, 97.
Tetragona, 49.
Tetranychus telarius, 133.
Tetrapedia diversipes, 57.
Thelairodes basalis, 102.
Thysanoptera, 113.
Tipulidæ from Porto Rico, 63.
Tipulidæ, New nearctic, 163.
Tornos scolopacinarius, 16.
Tricrania sanguinipennis, 208.

Trigona amalthea, 50.
Trigona amalthea, 60.
Trigona branneri, 50.
Trigona clavipes, 49.
Trigona flavipennis, 50.
Trigona frontalis, subsp. *flavocincta*, 50.
Trigona manni, 48, 49.
Trigona pallida, 49.
Trigona pellucida, 50.
Trigona rhodoptera, 49.
Trigona ruficrus, 50.
Trigona ruficrus, 60.
Trigona spp., 50.
Trigona williana, 49.
Trimicra pygmæa, 166.
Trophi, development of in Homoptera, 77.
Tydeus coccophagus, 208.
Tyroglyphus malus, 125.
Udamochiras colossia, 136.

Vermont, new species of Emesidæ from, 97.

Wohlfahrtia meigenii, 103.
Wohlfahrtia opaca, 103.

Xenomedon, 11.
Xenomedon formicaria, 12.
Xylocopa branneri, 42.
Xylocopa brasilianorum, 60.
Xylocopa frontalis morio, 60.
Xylocopa grisescens, 42, 60.
Xylocopa guatemalensis, 105.
Xylocopa wilmattæ, 106.

Yellow currant fly, 139.

Zygothrips americanus, 144.